Shri Vile Parle Kelavani Mandal's
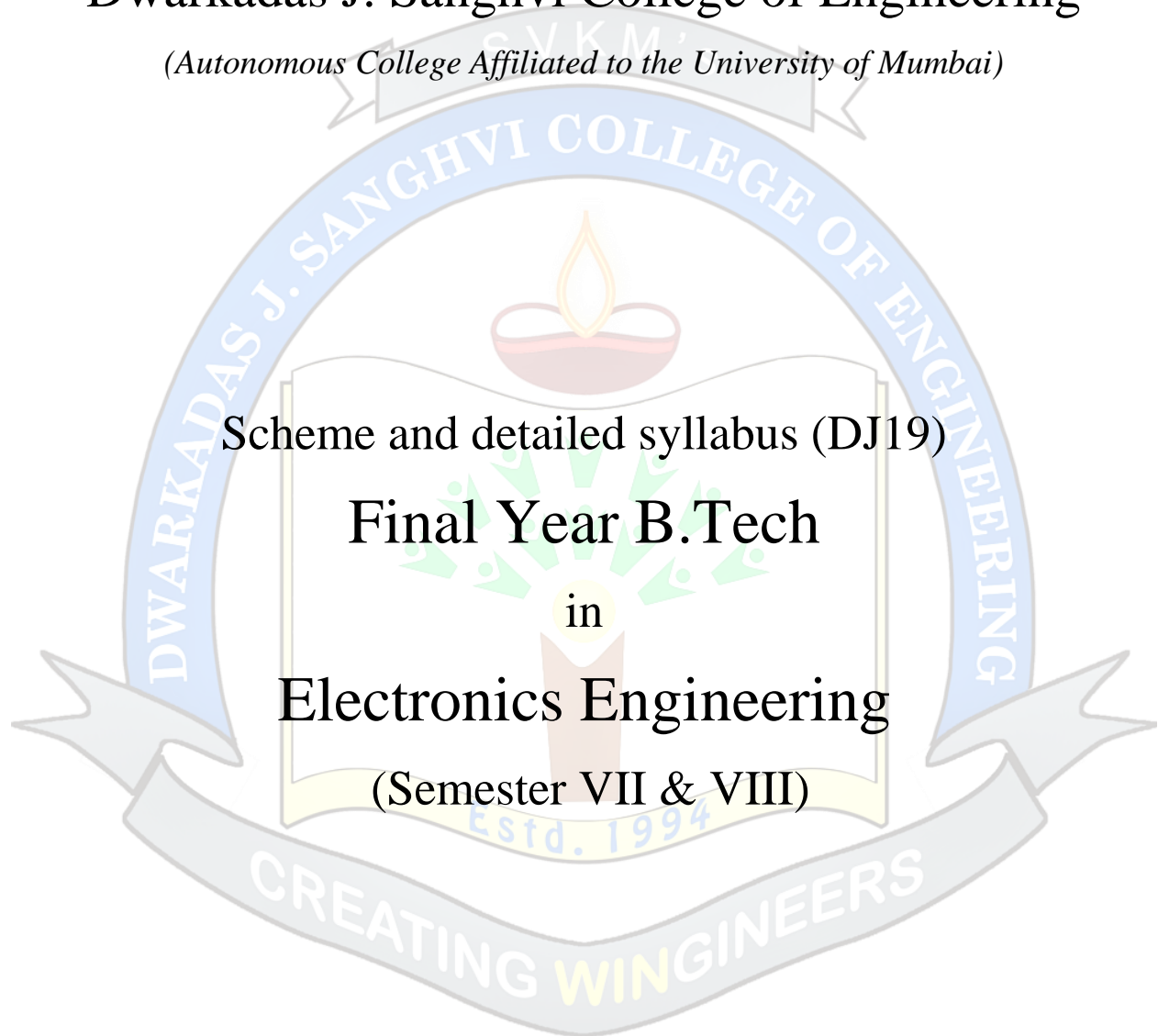
Dwarkadas J. Sanghvi College of Engineering

(Autonomous College Affiliated to the University of Mumbai)

Scheme and detailed syllabus (DJ19)

Final Year B.Tech

in

Electronics Engineering

(Semester VII & VIII)

Revision: 1 (2019)

With effect from the Academic Year: 2022-2023

Scheme for Final Year Undergraduate Program in Electronics Engineering : Semester VII (Autonomous)
(Academic Year 2022-2023)

Sr	Course Code	Course	Teaching Scheme				Semester End Examination (A)						Continuous Assessment (B)					Aggregate (A+B)	Credits earned	
			TH (hrs.)	PR (hrs.)	Tut (hrs.)	Credits	Duration (Hrs)	TH	Oral	PR	Oral & PR	SEE Total (A)	TT1	TT2	Avg	Term Work Total	CA Total (B)			
1	DJ19ELXC701	Artificial Intelligence and Machine Learning	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ELXL701	Artificial Intelligence and Machine Learning Laboratory	--	2	--	1	--	--	--	--	25	25	--	--	--	25	25	50	1	
2	DJ19ELXC702	IoT Enterprise Network	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ELXL702	IoT Enterprise Network Laboratory	--	2	--	1	--	--	--	--	25	25	--	--	--	25	25	50	1	
3 @	DJ19ELEC7031	Advanced Digital Signal Processing	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ELEL7031	Advanced Digital Signal Processing Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ELEC7032	Cloud Computing	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ELEL7032	Cloud Computing Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ELEC7033	Satellite and Optical Fiber Communication	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ELEL7033	Satellite and Optical Fiber Communication Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
4 #	DJ19ILO7011	Product Lifecycle Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	3
	DJ19ILO7012	Management Information System	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7013	Operations Research	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7014	Cyber Security and Laws	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7015	Personal Finance Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7016	Energy Audit and Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7017	Disaster Management and Mitigation Measures	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7018	Science of Wellbeing	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7019	Research Methodology	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO7020	Public Systems and Policies	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
5	DJ19ELXSBL3	Skill based Course - III Laboratory	--	4	--	2	--	--	--	--	25	25	--	--	--	50	50	75	2	2
6	DJ19ELXP704	Project Stage - I	--	6	--	3	--	--	--	--	50	50	--	--	--	50	50	100	3	3
		Total	12	16	--	20	--	300	25	--	125	450	100	100	100	175	275	725	20	

@ Department level elective (any one), # Institute level open elective (any one)

Scheme for Final Year Undergraduate Program in Electronics Engineering : Semester VIII (Autonomous)
(Academic Year 2022-2023)

Sr	Course Code	Course	Teaching Scheme				Semester End Examination (A)					Continuous Assessment (B)					Aggregate (A+B)	Credits earned	
			TH (hrs.)	PR (hrs.)	Tut (hrs.)	Credits	Duration (Hrs)	TH	Oral	PR	Oral & PR	SEE Total (A)	TT1	TT2	Avg	Term Work Total	CA Total (B)		
1	DJ19ELXC801	Robotics and Industrial Automation	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ELXL801	Robotics and Industrial Automation Laboratory	--	2	--	1	--	--	--	--	25	25	--	--	--	25	25	50	1	
2	DJ19ELXC802	Digital Image Processing	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ELXL802	Digital Image Processing Laboratory	--	2	--	1	--	--	--	--	25	25	--	--	--	25	25	50	1	
3 @	DJ19ELEC8041	IC and Bio-MEMS Technology	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	4
	DJ19ELEL8041	IC and Bio-MEMS Technology Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ELEC8042	Big Data Analytics	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ELEL8042	Big Data Analytics Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
	DJ19ELEC8043	Advanced Networking Technologies	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ELEL8043	Advanced Networking Technologies Laboratory	--	2	--	1	--	--	25	--	--	25	--	--	--	25	25	50	1	
4#	DJ19ILO8021	Project Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	3
	DJ19ILO8022	Entrepreneurship Development and Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO8023	Corporate Social Responsibility	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO8024	Human Resource Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO8025	Corporate Finance Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO8026	Logistics and Supply Chain Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO8027	IPR and Patenting	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO8028	Digital Marketing Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO8029	Environmental Management	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
	DJ19ILO8030	Labour and Corporate Law	3	--	--	3	3	75	--	--	--	75	25	25	25	--	25	100	3	
5	DJ19ELXP803	Project Stage - II	--	12	--	6	--	--	--	--	100	100	--	--	--	100	100	200	6	6
		Total	12	18	--	21	--	300	25	--	150	475	100	100	100	175	275	750	21	

@ Department level elective (any one), # Institute level open elective (any one)

Program: Final Year Electronics Engineering							Semester : VII			
Course : Artificial Intelligence and Machine Learning							Course Code:DJ19ELXC701			
Course : Artificial Intelligence and Machine Learning Laboratory							Course Code:DJ19ELXL701			
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)		Continuous Assessment Marks (B)			Total marks (A+ B)	
Lectures	Practical	Tutorial	Total Credits	Theory		Term Test 1	Term Test 2	Avg.		
				75		25	25	25	100	
				Laboratory Examination			Term work		Total Term work	50
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Assignment		
				--	--	25	15	10	25	

Pre-requisite: Students are required to have the following prerequisites:
1. Linear algebra (vectors, matrices, derivatives)
2. Basic probability theory
3. Python programming

Objectives:
1. Provide the basic ideas and techniques underlying the design of intelligent systems. Understanding of learning agent
2. Impart the knowledge of various search techniques for problem solving
3. Learn knowledge representation and provide the knowledge to deal with uncertain and incomplete information
4. To introduce students to the basic concepts and techniques of Machine Learning.
5. To become familiar with regression, classification and clustering tasks

Outcomes:
1. Develop a basic understanding of AI building blocks presented in intelligent agents.
2. Design appropriate problem solving method for an agent to find a sequence of actions to reach goal state.
3. Analyze various AI approaches to knowledge intensive problem solving, reasoning and planning.
4. Gain knowledge about basic concepts of Machine Learning
5. Solve the problems using various machine learning techniques

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Artificial Intelligence**	08
	1.1 Introduction, History of Artificial Intelligence, Definitions - Importance of AI, Evolution of AI, Applications of AI.	
	1.2 Intelligent Systems - Categorization of Intelligent System, Components of AI Program, Foundations of AI, Sub-areas of AI, Current trends in AI.	
	1.3 Intelligent Agents - Agents and Environments, The concept of rationality, The nature of environment, The structure of Agents, Types of Agents, Learning Agent.	
2	**Overview to Problem Solving**	08
	2.1 Solving problem by Searching - Problem Solving Agent, Formulating Problems, and Example Problems.	
	2.2 Search Methods - Uninformed search, Breadth First Search (BFS), Depth First Search (DFS), Depth Limited Search, Depth First Iterative Deepening (DFID).	
	2.3 Informed Search Methods - Greedy best first Search, A* Search, Memory bounded heuristic Search.	
	2.4 Local Search Algorithms and Optimization Problems - Hill climbing search, Simulated annealing, Local beam search, Genetic algorithms, Ant Colony Optimization.	
3	**Knowledge, Reasoning and Planning: Knowledge based agents**	07
	3.1 First order logic - syntax and Semantic, Knowledge Engineering in FOL.	
	3.2 Inference in FOL - Unification, Forward Chaining, Backward Chaining and Resolution, Planning Agent.	
	3.3 Types of Planning - Partial Order, Hierarchical Order, Conditional Order.	
4	**Introduction to Machine Learning**	05
	What is Machine Learning, Examples of Various Learning Paradigms, Perspectives and Issues, Version Spaces, Finite and Infinite Hypothesis Spaces, PAC Learning.	
5	**Supervised Learning: Classification and Regression Trees**	08
	5.1 Regression - Linear Regression, Multiple Linear Regression, Logistic Regression.	
	5.2 Neural Networks - Introduction, Perceptron, Multilayer Perceptron.	
	5.3 Support vector machines - Linear and Non-Linear, Kernel Functions, K-Nearest Neighbors.	
6	**Unsupervised Learning**	06

Self-Organizing Map, Expectation Maximization, Gaussian Mixture Models, Principal components analysis (PCA), Locally Linear Embedding (LLE), Factor Analysis.	
Total hours	**42**

Suggested List of Experiments:
(However Instructor is free to design his/her own experiments as per the guidelines)

Laboratory Experiments: (Any seven)
1. Select a problem statement relevant to AI.
    i)   Identify the problem
    ii)   PEAS Description
    iii) Problem formulation
2. Identify and analyze uninformed search Algorithm to solve the problem. Implement BFS/DFS/DFID search algorithms to reach goal state.
3. Identify and analyze informed search Algorithm to solve the problem. Implement A* search algorithm to reach goal state.
4. Program to implement Local Search algorithm: Hill climbing search
5. Program to implement learning: Perceptron Learning/Back propagation Algorithm.
6. Case study of an AI Application
7. To implement Linear Regression
8. To implement Logistic Regression
9. To implement Support Vector Machine.
10. To implement PCA.
11. Mini project based on any machine learning application.

Books Recommended:
Textbooks:
1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach", Second Edition, Pearson Education.
2. Saroj Kaushik "Artificial Intelligence", Cengage Learning.
3. George F Luger "Artificial Intelligence" Low Price Edition, Pearson Education., Fourth edition.
4. Deepak Khemani." A First Course in Artificial Intelligence", McGraw Hill Education (India), 2013
5. Peter Harrington "Machine Learning In Action", DreamTech Press
6. Ethem Alpaydın "Introduction to Machine Learning", MIT Press
7. Tom M.Mitchell "Machine Learning", McGraw Hill
8. Stephen Marsland "Machine Learning An Algorithmic Perspective", CRC Press

Reference Books:
1. Ivan Bratko "PROLOG Programming for Artificial Intelligence", Pearson Education, Third Edition.
2. Elaine Rich and Kevin Knight "Artificial Intelligence" Third Edition
3. Davis E.Goldberg , "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
4. Hagan, Demuth, Beale, "Neural Network Design" CENGAGE Learning, India Edition.
5. Patrick Henry Winston, "Artificial Intelligence", Addison-Wesley, Third Edition.
6. Han Kamber, "Data Mining Concepts and Techniques", Morgann Kaufmann Publishers.
7. N.P.Padhy , "Artificial Intelligence and Intelligent Systems", Oxford University Press.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Oral Examination:

1. Oral examination will be based on the entire syllabus including, the practical performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Term Work:

Term work shall consist of minimum seven experiments/simulations, one case study/mini-project and two assignments/quiz.

The distribution of marks for term work shall be as follows:

Laboratory work:	15 Marks
Assignment/Quiz:	10 Marks
Total:	**25 Marks**

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.
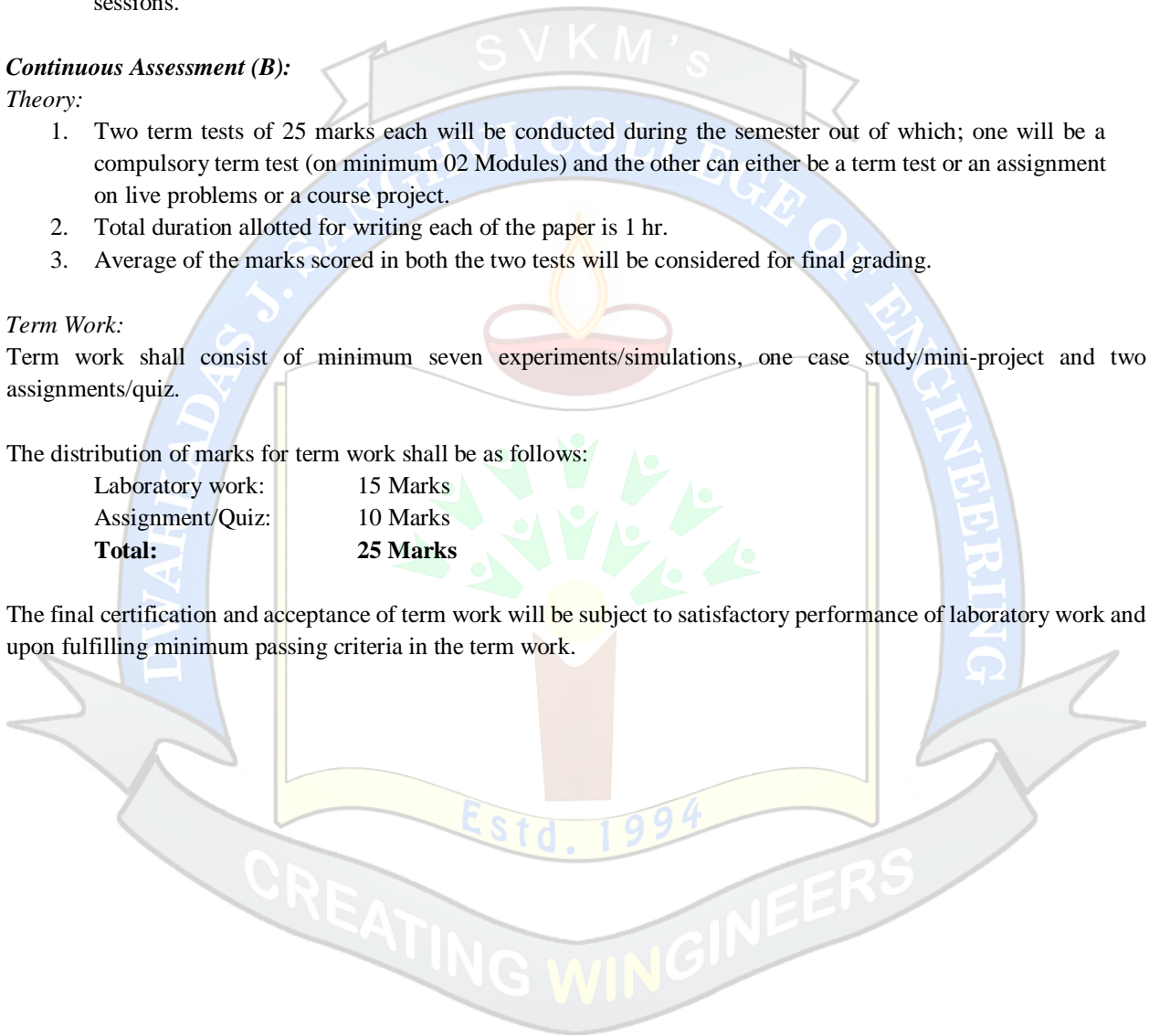
Prof. Bahar Soparkar	Prof. Sejal Kadam	Dr. Prasad Joshi	Dr. Hari Vasudevan
Prepared by	Checked by	Head of the Department	Principal

Program: Final Year Electronics Engineering							Semester: VII		
Course: IoT Enterprise Network							Course Code:DJ19ELXC702		
Course: IoT Enterprise Network Laboratory							Course Code:DJ19ELXL702		

Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)		Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory		Term Test 1	Term Test 2	Avg.	
				75		25	25	25	100
				Laboratory Examination			Term work		
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation / Journal	Total Term work
									50
				25	--	--	15	10	25

Pre-requisites: Knowledge of
1. Analog and Digital Communication,
2. Embedded Systems and RTOS.

Objectives:
1. Comprehend and differentiate between wired & wireless networks and understand the TCP/IP suite
2. Differentiate & evaluate existing power management mechanisms for power constrained applications in IoT
3. Differentiate & discriminate between existing wireless topologies, technologies & protocols as per requirement
4. Comprehend the security challenges for IoT Domain & evaluate existing SaaS, PaaS and IaaS services

Outcomes: On completion of the course, learner will be able to:
1. Outline application & link layer services for wired and wireless applications
2. Design & optimize – sensors, power modules and actuation for constrained environment applications
3. Comprehend and evaluate the mechanism needed for network security of application environment
4. Demonstrate the use of SaaS, PaaS and IaaS services

Detailed Syllabus: (unit wise)		
Unit	Description	Duration
1	**Introduction to Computer Networks** 1.1 Network Protocol Stack- OSI & TCP/IP Model 1.2 IoT Enterprise Architecture – Switches, Routers & Gateways 1.3 IP Addressing, Sub-netting & Routing (OSPF, RIP, EIGRP & BGP) 1.4 ARP, DHCP, MODBUS-TCP, SMTP (POP3 & IMAP), HTTPS, DNS-DDNS & FTP Protocols	14

2	**IoT- Power Management Challenges & Sensor actuation technology**	06
	2.1 Applications, Challenges and Power Management in devices using Battery life calculation	
	2.2 Battery types, Power Management Algorithms & Power Optimization	
	2.3 Energy Harvesting & modern sensor-actuator technology	
3	**Wireless Technologies & IoT Protocols**	08
	3.1 IEEE 802.11 standards, BLE, IEEE 802.15.4 – RFID, 6LoWPAN, & Zigbee	
	3.2 LP-WAN Technologies – NBIoT, LTE – M1, LoRa & BLE Mesh	
	3.3 CoAP- Constrained Application Protocol & MQTT- Message Queuing Telemetry Transport	
	3.4 Applications of IoT Design Technologies – Smart utility meters with IoT gateways	
4	**Cybersecurity**	12
	4.1 Network Security- Packet Sniffing, ARP and IP Spoofing, Denial of Service attacks, Firewalls & Intrusion Prevention System	
	4.2 Block Ciphers- Data Encryption Standard- DES, Advanced Encryption Standard- AES & RSA Algorithm	
	4.3 Cryptographic Hashes & Message Digest – MD5, SHA, CMAC, HMAC	
	4.4 Internet Security Protocols – SSL, TLS and IPSec	
5	**Cloud Services**	02
	5.1 Virtualization – Taxonomy & Implementation of levels of Virtualization	
	5.2 Cloud Computing Architecture – Exploring AWS components: EC2, and S3 services	
	Total hours	**42**

Suggested List of Experiments:
(*However Instructor is free to design his/her own experiments as per the guidelines*)
Laboratory Experiments: (Any seven)

1. Device Functionalities using Cisco Packet Tracer - Implementing Hubs, Switches & Routers
2. IP addressing & Multi-path routing using Wired & Wireless Protocols (RIP & OSPF)
3. Understanding Load Balancing & Server Load, Ethernet delay using Riverbed Modeler
4. Implementing MQTT (Smart utility meter - Paho MQTT client & Mosquitto Broker) with Raspberry Pi
5. Implementing LoRa with MQTT & using AWS services as broker-storage
6. Using YABE, BACnet & MQTT box to report IAQ sensor data – How to write reports for functional testing of IoT gateways
7. Cybersecurity: Using Wireshark & NMAP for packet tracing in promiscuous & non-promiscuous mode using Packet Filters and demonstrate ARP Spoofing and Port Scanning – Reconnaissance tools
8. Implement a hashing-cryptography mechanism using Pycryptodome
9. Create and run a Virtual Machine on a hosted Hypervisor – Oracle Virtualbox
10. Explore AWS EC2, S3 & Network Security Services provided by AWS

Books Recommended:

Textbooks:

1. Ames Kurose, Keith Ross,"Computer Networking: A Top - Down Approach".
2. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach, Universities Press.
3. Raj Kamal, "Internet of Things: Architecture and Design Principles", McGraw Hill Education, First edition.
4. David Hanes, Gonzalo Salgueiro"IoT Fundamentals Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, Kindle 2017 Edition.

Reference Books:
1. Judith Hurwitz, "Cloud Computing for Dummies", Wiley Publication.
2. Wireless Communications and networks", William Stallings, Pearson / Prentice Hall
3. Cryptography and Network Security, Atul Kahate, Tata Mc Graw Hill.
4. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Paperback,
5. First Edition.
6. Yashavant Kanetkar , Shrirang Korde :Paperback "21 Internet of Things (IOT) Experiments" BPB Publications.
7. Nishith Tripathi, Jeffery H Reed, Wiley Publication, "Cellular Communications: A Comprehensive and Practical Guide".
8. William Stallings, "Cryptography and Network Security, Principles and Practice", Pearson Education.
9. Behrouz A. Forouzan, "Cryptography & Network Security", Tata Mc Graw Hill.
10. Barrie Sosinsky, "Cloud Computing Bible", Wiley Publication.
11. Dr. Deven Shah, et al, "Cloud Computing Black Book", Dreamtech Press.

Evaluation Scheme:
Semester End Examination (A):
Theory:
1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:
1. Oral examination will be based on the entire syllabus including, the practical performed during laboratory sessions.

Continuous Assessment (B):
Theory:
1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.

Laboratory: (Term work)
Term work shall consist of minimum 7 experiments, 1 Power Point Presentation and minimum 2 assignments.

The distribution of marks for term work shall be as follows:

Laboratory work:	15 Marks
Assignment/Quiz:	10 Marks
Total:	**25 Marks**

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prof. Mayur V. Parulekar	Prof. Rashmi Ravikumar	Dr. Prasad Joshi	Dr. Hari Vasudevan
Prepared by	Checked by	Head of the Department	Principal

Program: Fourth Year Electronics Engineering								Semester: VII	

Program: Fourth Year Electronics Engineering	Semester: VII
Course: Advanced Digital Signal Processing	Course Code: DJ19ELEC7031
Course: Advanced Digital Signal Processing Laboratory	Course Code: DJ19ELEL7031

Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)		Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory		Term Test 1	Term Test 2	Avg.	
				75		25	25	25	100
				Laboratory Examination			Term work		Total Term work
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	
				25	--	--	15	10	25

Pre-requisite: Knowledge of
1. Advanced Engineering Mathematics
2. Digital Signal Processing

Objectives:
1. To understand the effect of hardware limitations on performance of digital filters.
2. To understand the concept of multirate signal processing.
3. To understand linear prediction and optimum linear filtering.
4. To understand Adaptive Filtering and Wavelet.

Outcomes: On completion of the course, learner will be able to:
1. Analyze the effect of hardware limitations on performance of digital filters.
2. Implement multistage sampling rate conversion.
3. Analyze linear prediction methods and optimum linear filters.
4. Implement adaptive filters for given applications.
5. Analyze wavelet theory for various applications

Detailed Syllabus: (unit wise)		
Unit	Description	Duration
1	**Finite Word Length Effects in Digital Filters** 1.1 Quantization, truncation and rounding, Effects due to truncation and rounding, Input quantization error, Product quantization error, Co-efficient quantization error, Zero-input limit cycle oscillations, Overflow limit cycle oscillations 1.2 Quantization in Floating Point realization of IIR digital filters, Finite word length effects in FIR digital filters	06

2	**Multirate DSP and Filter Banks**	08
	2.1 Introduction and concept of Multirate Processing, Block Diagram of Decimator and Interpolator, Decimation and Interpolation by Integer numbers Multistage Approach to Sampling rate converters	
	2.2 Sample rate conversion using Polyphase filter structure, Type I and Type II Polyphase Decomposition	
3	**Linear Prediction and Optimum Linear Filters**:	10
	3.1 Representation of Stationary Random Process	
	3.2 Forward and Backward Linear Prediction	
	3.3 Solution of Normal Equation (Levinson-Durbin and Schur Algorithm)	
	3.4 AR Lattice and ARMA Lattice Ladder Filters	
	3.5 Weiner Filters for Filtering and Prediction	
	3.6 Discrete Kalman Filter	
4	**Adaptive Filters**	10
	4.1 Applications of Adaptive Filters: System Identification, Adaptive Channel Equalization, Echo Cancellation, Adaptive Noise Cancellation, Suppression of Narrowband Interference in Wideband Signals, Adaptive Arrays.	
	4.2 Adaptive Algorithms: LMS Algorithm, RLS Algorithm, Lattice Ladder Algorithm	
5	**Wavelet Transform**	08
	5.1 Introduction to Time Frequency Analysis	
	5.2 Short Time Fourier Transform	
	5.3 Continuous Wavelet Transform	
	5.4 Discrete Wavelet Transform	
	5.5 Multiresolution Analysis	
	5.6 Application	
	Total hours	42

Suggested List of Experiments:

(*However Instructor is free to design his/her own experiments as per the guidelines*)
Laboratory Experiments:
1. To perform up sampling & down sampling
2. To design FIR Weiner filter for noise cancellation.
3. To demonstrate LMS algorithm for noise cancellations.
4. To demonstrate RLS algorithm to calculate it's error function.
5. To study different types of wavelet functions
6. To demonstrate application of Wavelet Transform for denoising.

Laboratory experiment along with tutorials based on syllabus may be included, which would help the learner to understand topic/concept.

Books Recommended:
Textbooks:
1. Monson H. Hayes - Statistical Digital Signal Processing and Modeling, John Wiley & Sons
2. John G. Proakis, Dimitris G. Monolakis ― Digital Signal Processing, PHI 2007.
3. Emmanuel C. Ifeachor, Barrie W. Jervis, ―Digital Signal Processing A Practical Approach, Pearson Education 2008.

Reference Books:
1. Simon Haykin, ―Adaptive Filter Theory, Pearson Education 2013.

2. Tarun Kumar Rawat, ―Digital Signal Processing, Oxford University Press.
3. Raghuveer M. Rao and Ajit S. Bopardikar, ―Wavelet Transforms ―Introduction to Theory and Applications, Pearson Education Asia 2000.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practical performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 8 tutorials/experiments and 1 Power Point Presentation.

The distribution of marks for term work shall be as follows:

Laboratory work:	15 Marks
Presentation:	10 Marks
Total:	**25 Marks**

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prof. Sejal Kadam	Dr. Prasad Joshi	Dr. Prasad Joshi	Dr. Hari Vasudevan
Prepared by	Checked by	Head of the Department	Principal

Program: Final Year Electronics Engineering								Semester : VII	
Course : Cloud Computing								Course Code: DJ19ELEC7032	
Course : Cloud Computing Laboratory								Course Code: DJ19ELEC7032	

Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)		Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory		Term Test 1	Term Test 2	Avg.	
				75		25	25	25	100
				Laboratory Examination			Term work		
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	Total Term work	50
				25	--	--	15	10	25

Pre-requisite: Knowledge of Computer Networks and Operating System.

Objectives:
This course gives students an insight into the basics of cloud computing along with virtualization and various cloud computing services. The students will get hands-on experience on Amazon Web Services (AWS) and its components.

Outcomes: On completion of the course, learner will be able to:
1. Implement Virtualization using different types of hypervisors.
2. Provide the appropriate cloud computing solutions.
3. Design & develop backup strategies for cloud data.

Detailed Syllabus: (unit wise)		
Unit	Description	Duration
1	**Introduction** Defining Cloud Computing, Cloud and other similar configurations, Components of Cloud Computing, Cloud types: NIST Model, Cloud Deployment Models and Service Models, Advantages and Disadvantages of Cloud Computing.	06
2	**Virtualization** Characteristics of virtualized environment, Type I & Type II Hypervisors, Taxonomy of virtualization, Implementation Levels of Virtualization, Virtualization of CPU, Memory and I/O Devices, Virtualization and Cloud Computing, Pros and Cons of virtualization, Technology Examples: KVM, Xen, Vmware and HyperV	08

3	**Cloud Computing Services**	
	3.1 Exploring Cloud Computing Services - SPI Model: Software as a service, Platform as a service, and Infrastructure as a service.	
	3.2 Anything as a service or Everything as a service (XaaS) - Security as a Service, Identity management as a Service, Database as a Service, Storage as a Service, Communication as a Service, Network as a Service, Disaster recovery as a service, Analytics as a Service, Backup as a Service.	04
4	**Programming support for Google apps engine**	
	4.1 Google File System (GFS), Bigtables, Chubby, Google APIs.	07
	4.2 Mobile Cloud Computing - Definition, architecture, benefits and challenges of mobile cloud computing	
5	**Exploring the Components of Amazon Web Services**	
	5.1 AWS cloud computing platform, Elastic Compute Cloud (EC2) - Compute Basics, Instance types, Life cycle of instances.	
	5.2 Simple Storage Service (S3) - Basics and Operations, Features, Amazon Glacier, Glacier vs S3.	
	5.3 Elastic Block Storage (EBS) - Basics and Types of EBS Volumes	08
	5.4 Amazon Virtual Private Cloud (Amazon VPC) - Subnets, Route tables, Elastic IP Addresses (EIP), Elastic Network Interfaces (ENIs), Security groups & ACL.	
	5.5 Elastic Load Balancing (ELB) - Basics, Types of load balancers, Configuring Elastic Load Balancing, Basics of Cloud Watch & Auto Scaling.	
6	**Working with Cloud-Based Storage**	
	6.1 Working with Cloud-Based Storage - Provisioning Cloud Storage, Exploring Cloud Backup Solutions, Cloud Storage Interoperability: Cloud Data Management Interface (CDMI) and Open Cloud Computing Interface (OCCI).	
	6.2 Cloud Analytics for IoT Applications - Role of Cloud Computing in IoT, Connecting IoT to cloud, Cloud Storage for IoT, Challenges in integration of IoT with Cloud, Cloud Based IoT Services (XIVELY, NIMBITS).	09
	Total hours	**42**

Suggested List of Experiments:
(*However Instructor is free to design his/her own experiments as per the guidelines*)

Laboratory Experiments: (Any seven)
1. Study of NIST framework of Cloud Computing (Case Study).
2. Creating and running virtual machines on Hosted Hypervisors like Oracle Virtualbox.
3. Creating and running virtual machines on Hosted Hypervisors like KVM.
4. Demonstrate virtual machines on Bare-Metal Hypervisors Type 0 like Xen, Vmware ESXI or HyperV.
5. To execute the basic commands of Docker and deploy a multi – service application using Play with Docker Classroom.
6. Database as a Service using MongoDB Atlas.
7. To create simple wordpress app using Lightsail service in AWS (SAAS).
8. To demonstrate and implement IaaS service using AWS (Use t2. Micro (Free tier eligible instance only).
9. Explore Storage as a service using own Cloud for remote file access using web interfaces.
10. Cloud analytics on IoT data.

Books Recommended:
Textbooks:
1. Barrie Sosinsky, "Cloud Computing Bible", Wiley Publication.

2. Kailash Jayaswal, Jagannath Kallalurchi, Donald J. Houde, Dr.Deven Shah, "Cloud Computing Black Book", Dreamtech Press.
3. Joe Baron et.al, "AWS certified solution Architect", Sybex publication.
4. Mastering Cloud Computing, Rajkumar Buyya, MGH publication

Reference Books:
1. Learn to Master Cloud Computing by Star EduSolutions
2. Kai Hwang, "Distributed and Cloud Computing", MK Publication
3. Thomas Erl, Robert Cope, Amin naserpour, "Cloud Computing Design Patterns", Pearson Publication.
4. Judith Hurwitz, "Cloud Computing for Dummies", Wiley Publication.

Web Resources:
1. https://aws.amazon.com/
2. https://owncloud.org/
3. https://console.cloud.google.com/appengine/start?src=ac&project=inlaid-stratum-308611

Evaluation Scheme:
Semester End Examination (A):
Theory:
1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:
1. Oral examination will be based on the entire syllabus including, the practical performed during laboratory sessions.

Continuous Assessment (B):
Theory:
1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)
Term work shall consist of minimum 7 experiments, 1 Power Point Presentation and minimum 2 assignments.
The distribution of marks for term work shall be as follows:

Laboratory work:	15 Marks
Assignment/Quiz:	10 Marks
Total:	**25 Marks**

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Dr. Vinaya Sawant	Prof. Darshana Sankhe	Dr. Prasad Joshi	Dr. Hari Vasudevan
Prepared by	Checked by	Head of the Department	Principal

Program: Final Year Electronics Engineering						Semester : VII			
Course : Satellite and Optical Fiber Communication						Course Code: DJ19ELEC7033			
Course : Satellite and Optical Fiber Communication Laboratory						Course Code: DJ19ELEL7033			
Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)		Continuous Assessment Marks (B)			Total marks (A+ B)
				Theory		Term Test 1	Term Test 2	Avg.	
Lectures	Practical	Tutorial	Total Credits	75		25	25	25	100
				Laboratory Examination			Term work		
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	Total Term work	50
				25	--	--	15	10	25

Pre-requisite: Knowledge of
1. Physics
2. Electronics Devices and Circuits
3. Analog and Digital Communication

Objectives:
1. To understand the basics of satellite communications, different satellite communication orbits and effects
2. Provide an in-depth understanding of satellite sub-systems, earth station and applications
3. To understand the fundamentals and characteristics of optical fiber communication
4. To understand the operation and characteristics of various optical sources, detectors and various fiber optic components

Outcomes: On completion of the course, learner will be able to:
1. Differentiate satellite orbits and orbital parameters
2. Describe different satellite sub-systems operation and earth station technology
3. Elaborate various applications of satellite communications
4. Describe the fundamentals and transmission characteristics of optical fiber Communication.
5. Analyze various optical sources, detectors and fiber optic components
6. Analyze the optical link budget

Unit	Description	Duration
**Detailed Syllabus: (unit wise)**		
1	**Basics of Satellite Communication** Introduction to orbits, Kepler's laws, orbital parameters and their effects on satellite signal, apogee, perigee heights, orbital perturbations, effects of a non-spherical earth, atmospheric drag, sub-satellite point, Look angles, Limits of visibility, earth eclipse of satellite, sun transit outage.	06
2	**Satellite sub-systems and Earth station** 2.1 Satellite sub-systems - Satellite configuration, Transponder sub-system, Antenna sub-system, AOC Sub-system, TT&C sub-system and reliability. 2.2 Earth station - General configuration- Block diagram, Receive only type earth, transmit-receive type earth station, Antenna system, Feed system, Tracking system, LNA, HPA.	07
3	**Satellite Applications** VSAT systems, Broadcast services (Television broadcast systems, DAB), Mobile satellite communication (INMARSAT, LMSS, mobile satellite systems with non GEO satellites), Satellite navigation systems, Satellite based internet (Starlink), Earth observation applications (Urban planning, Oceanography, agriculture services), Space science applications (Moon topography, Planet investigation), Anti-Satellite.	08
4	**Optical Fiber and their Transmission Characteristics** 4.1 General system, advantages, disadvantages, and applications of optical fiber communication, optical fiber waveguides, Ray theory, cylindrical fiber (no derivations), Wave guiding principles, Types and classification of optical fibers (single mode fiber, Multi-mode fiber). 4.2 Transmission Characteristics - Attenuation, absorption, scattering losses, bending losses, dispersions.	08
5	**Optical Sources and Detectors** 5.1 Sources - Working principle and characteristics of sources (LED, LASER), Tunable lasers, Quantum well lasers, Surface Emitting Lasers. 5.2 Detectors - Working principle and characteristics of detectors (PIN, APD), Resonant cavity enhancement (RCE) Photo Detector, Coherent and non-coherent detection.	07
6	**Optical Link** 6.1 Fiber Optic Components - Fiber joints, fiber connectors, splices, couplers, multiplexers, filters, wavelength converters, optical amplifiers, routing fiber to other networks. 6.2 Optical Link - Introduction, Point to point links, system considerations, link power budget.	06
	Total hours	42

Suggested List of Experiments:
(However Instructor is free to design his/her own experiments as per the guidelines)

Laboratory Experiments: (Any seven)

1. To study Active and Passive satellite.
2. To study transmission and reception of 1 KHz tone signal through satellite link.
3. To study transmission of video and audio signal over satellite link.
4. To find the time delay for transmission and reception of satellite data between earth stations.
5. To study effect of multipath fading, path loss and propagation delay on satellite signal.

6. Calculation of Numerical aperture
7. Calculation of link Loss, dispersion for given link
8. Performance analysis of Single mode fiber
9. Performance Analysis of Optical Link with Different Sources
10. Performance Analysis of Optical Link with Different Detectors
11. Presentations on the relevant topics.

Books Recommended:

Textbooks:
1. Satellite Communications - Timothy Pratt, Charles W. Bostian, John Wiley, 2002
2. Satellite Communications - Dennis Roddy, 4th Ed., Mc. Graw-Hill International Ed. 2009.
3. Optical Fiber Communication – Gerd Keiser, 4th Ed., MGH, 2008.
4. Optical Fiber Communications – John M. Senior, Pearson Education. 3rd Impression, 2007.

Reference Books:
1. Satellite Communication Systems Design Principles - M. Richharia, Macmillan Press Ltd. Second Edition 2003.
2. Satellite Communication Systems - Gerard Maral and Michel Bousquet, 4th Edition Wiley Publication
3. VSAT Networks - Gerard Maral, John Willy & Sons
4. Fiber optics communications - Harold Kolimbiris
5. Introduction to optical fibers, Cheri, McGraw Hill.
6. Fiber optic communication– Joseph C Palais: 4th Edition, Pearson Education

Evaluation Scheme:

Semester End Examination (A):
Theory:
1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:
1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:
1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 7 experiments, 1 Power Point Presentation and minimum 2 assignments.

The distribution of marks for term work shall be as follows:

Laboratory work:	15 Marks
Assignment/Quiz:	10 Marks
Total:	**25 Marks**

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prof. Darshana Sankhe	Prof. Rashmi Ravikumar	Dr. Prasad Joshi	Dr. Hari Vasudevan
Prepared by	Checked by	Head of the Department	Principal

Program: Final Year (Common for All Programs)							Semester: VII			
Course: Product Life Cycle Management							Course Code: DJ19ILO7011			

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)		Continuous Assessment Marks (B)				Total marks (A+ B)
				Theory		Term Test 1	Term Test 2	Avg.		
Lectures	Practical	Tutorial	Total Credits	75		25	25	25		100
				Laboratory Examination		Term work			Total Term work	
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		--
				--	--	--	--	--	--	

Pre-requisite: Knowledge of basic concepts of Management.

Objectives:
1. To familiarize the students with the need, benefits and components of PLM
2. To acquaint students with Product Data Management & PLM strategies
3. To give insights into new product development program and guidelines for designing and developing a product
4. To familiarize the students with Virtual Product Development

Outcomes: On completion of the course, learner will be able to:
1. Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation.
2. Illustrate various approaches and techniques for designing and developing products.
3. Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc.
4. Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant

Syllabus for Final Year of B.Tech. (Common for All Programs)
Semester VII (Autonomous)
(Academic Year 2022-2023)

Detailed Syllabus (Unit wise)		
Unit	**Description**	**Duration in Hours**
1	**Introduction to Product Lifecycle Management (PLM):** Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications **PLM Strategies:** Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM	10
2	**Product Design:** Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process	08
3	**Product Data Management (PDM):** Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation **Virtual Product Development Tools:** For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modelling and simulations in Product Design, Examples/Case studies	08
4	**Integration of Environmental Aspects in Product Design:** Sustainable Development Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design.	08
5	**Life Cycle Assessment and Life Cycle Cost Analysis:** Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis	08

Books Recommended:

Text books:
1. Product Lifecycle Management: Paradigm for 21st Century Product Realization, John Stark, Springer-Verlag, 2004.
2. Product Design for the environment-A life cycle approach, Fabio Giudice, Guido La Rosa, Antonino Risitano, Taylor & Francis 2006.

Reference Books:

1. Product Life Cycle Managementǁ, Saaksvuori Antti, Immonen Anselmie, Springer, Dreamtech.
2. Product Lifecycle Management: Driving the next generation of lean thinking, Michael Grieve, Tata McGraw Hill, 2006.
3. Product Life-Cycle Management: Geometric Variations, François Villeneuve, Luc Mathieu, Max Giordano, Wiley, 2010.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Program: Final Year (Common for All Programs)						Semester: VII				
Course: Management Information System						Course Code: DJ19ILO7012				

Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)		Continuous Assessment Marks (B)			Total marks (A+ B)	
				Theory		Term Test 1	Term Test 2	Avg.		
Lectures	Practical	Tutorial	Total Credits	75		25	25	25	100	
				Laboratory Examination		Term work			Total Term work	
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		--
				--	--	--	--	--	--	

Objectives:
1. The course is blend of Management and Technical field.
2. Discuss the roles played by information technology in today's business and define various technology architectures on which information systems are built
3. Define and analyze typical functional information systems and identify how they meet the needs of the firm to deliver efficiency and competitive advantage
4. Identify the basic steps in systems development

Outcomes: Learner will be able to…
1. Explain how information systems Transform Business
2. Identify the impact information systems have on an organization
3. Describe IT infrastructure and its components and its current trends
4. Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making
5. Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses

	Detailed Syllabus (Unit wise)	
Unit	Description	Duration in Hours
1	**Foundation Concepts:** Information Systems in Business, Functional Area Information System**,** The Components of Information Systems**,** Impact of IT on organizations and society, Organizational Strategy, Information systems for strategic advantage.	05
2	**Information Technologies:** Hardware and Software **Computer Systems:** End User and Enterprise Computing **Computer Peripherals:** Input, Output, and Storage Technologies **Application Software:** End User Applications **System Software:** Computer System Management **Data Resource Management:** Technical Foundations of Database Management, Managing Data Resources, Big data, Data warehouse and Data Marts**,** Knowledge Management **Networks:** The Networked Enterprise (Wired and wireless), Pervasive computing, Cloud Computing models	08
3	**MIS Tools and applications for Decision making:** ERP and ERP support of Business Process Reengineering, **Business intelligence (BI):** Managers and Decision Making, BI for Data analysis and Visualization **Artificial Intelligence Technologies in Business**	08
4	**Security and Ethical Challenges:** Security, Ethical, and Societal Challenges of IT Security Management of Information Technology	06
5	**Social Computing (SC):** Web 2.0 and 3.0, SC in business-shopping, Marketing, Operational and Analytic CRM, E-business and E-commerce – B2B B2C, Mobile commerce.	07
6	**Information System within Organization:** Acquiring Information Systems and Applications: Various System development life cycle models. **Enterprise and Global Management of Information Technology:** Managing Information Technology, Managing Global IT.	08

Books Recommended:

Reference Books:
1. Management Information Systems, 11th edition by James A O'Brien, George M., Ramesh Behl.
2. Kelly Rainer, Brad Prince, Management Information Systems, Wiley.
3. K.C. Laudon and J.P. Laudon, Management Information Systems: Managing the Digital Firm, 10th Ed., Prentice Hall, 2007.
4. D. Boddy, A. Boonstra, Managing Information Systems: Strategy and Organization, Prentice Hall, 2008

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Program: Final Year (Common for All Programs)							Semester: VII		
Course: Operations Research							Course Code: DJ19ILO7013		
Teaching Scheme (Hours / week)				**Evaluation Scheme**					
				Semester End Examination Marks (A)	**Continuous Assessment Marks (B)**				**Total marks (A+ B)**
				Theory	**Term Test 1**	**Term Test 2**	**Avg.**		
Lectures	**Practical**	**Tutorial**	**Total Credits**	75	25	25	25		100
				Laboratory Examination	**Term work**		**Total Term work**		--
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	
				--	--	--	--	--	--

Pre-requisites: Basic Knowledge of Algebra, Probability and Statistics.

Objectives:
1. To formulate a real-world decision problem as a mathematical programming model.
2. To learn the mathematical tools that are employed to solve mathematical programming models.

Outcomes: On completion of the course, learner will be able to:
1. **Convert** a real-world problem in to a Linear Programming Problem and **analyse** the solution obtained using Simplex method or other algorithms.
2. **Identify** real-world problems as Transportation Problem and Assignment Problem and **Solve** the decision problem by choosing appropriate algorithm.
3. **Identify** the decision situations which vary with time and **analyse** them using principle of dynamic programming to real life situations.
4. **Explain** reasons of formation of queues, classify various queuing systems and **apply** parameters defined for various queuing systems for decision making in real life situations.
5. **Understand** the concept of decision making in situation of competition and **recommend** strategies in case of two-person zero sum games.
6. **Describe** concept of simulation and **apply** Monte Carlo Simulation technique to systems such as inventory, queuing and **recommend** solutions for them.
7. **Understand** need for right replacement policy and **determine** optimal replacement age.

Syllabus for Final Year of B.Tech. (Common for All Programs)
Semester VII (Autonomous)
(Academic Year 2022-2023)

	Detailed Syllabus (Unit wise)	
Unit	**Description**	**Duration in Hours**
1	**Introduction to Operations Research:** Concept of decision making. Definition of OR. Formulation of decision problem as OR model, Concept of Optimization, **Linear Programming Problem:** Mathematical Formulation. Finding optimal solution - Graphical method, Simplex Method, Big M-method, Two Phase Method. Duality, Primal – Dual construction, Symmetric and Asymmetric Dual. Dual Simplex Method.	10
2	**Assignment Problems:** Mathematical Formulation, Finding optimal solution - Hungarian Method **Transportation problem:** Mathematical Formulation, Finding initial basic feasible solution – Northwest corner rule, row minima, column minima, least cost method and Vogel's approximation method. Optimality test: the stepping stone method and MODI method. Improving the solution.	08
3	**Dynamic Programming**: Bellman's Principle of optimality - Applications of dynamic programming- Employment smoothening problem, capital budgeting problem, shortest path problem, cargo loading problem	06
4	**Queuing Models:** Characteristics of queuing models. Single Channel – Single and multi phase servers, Poisson arrivals, exponential service time - with infinite population and finite population models – with infinite and finite capacity. Multichannel – Single phase server - Poisson arrivals, exponential service time with infinite population. **Game Theory:** Introduction. Minimax & Maximin Criterion and optimal strategy. Solution of games with saddle points, rectangular games without saddle points - 2 x 2 games, dominance principle. Approximate methods - Iterative method, m x 2 & 2 x n games -Graphical method and method of sub-games. Expressing game as LPP.	10
5	**Simulation:** Definition. Types of simulation models. Monte Carlo simulation technique. Applications of simulation - Inventory and Queuing problems. Simulation Languages. **Replacement Models:** Replacement of items that deteriorate with time - when money value is not counted and counted, Replacement of items that fail suddenly – individual and group replacement policy.	08

Note: Educator is expected to introduce relevant software available for solving various mathematical models.

Books Recommended:
Text books:
1. Operations Research, Sharma J. K., Trinity Press
2. Operations Research, Gupta P. K., Hira D. S., S. Chand Limited

Reference Books:
1. Operations Research - An Introduction; Taha, H.A.; Prentice Hall

2. Operations Research: Principles and Practice; Ravindran, A, Phillips, D. T and Solberg, J. J.; John Willey and Sons
3. Introduction to Operations Research; Hiller, F. S. and Liebermann, G. J.; Tata McGraw Hill
4. Operations Research Principles and Practice; Pradeep Prabhakar Pai; Oxford University Press
5. Operations Research, R. Panneerselvam, PHI Publications.
6. Operations Research, A. M. Natarajan, P. Balasubramani, A. Tamilarasi, Pearson Education.
7. Operations Research; Kanti Swarup, P. K. Gupta and Man Mohan; Sultan Chand & Sons

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Program: Final Year (Common for All Programs)						Semester: VII			
Course: Personal Finance Management						Course Code: DJ19ILO7015			
Teaching Scheme (Hours / week)				**Evaluation Scheme**					
				Semester End Examination Marks (A)		**Continuous Assessment Marks (B)**			**Total marks (A+ B)**
				Theory		**Term Test 1**	**Term Test 2**	**Avg.**	
Lectures	**Practical**	**Tutorial**	**Total Credits**	75		25	25	25	100
				Laboratory Examination		**Term work**		**Total Term work**	--
				Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	
3	--	--	3	--	--	--	--	--	--

Pre-requisites: Basic Knowledge of Algebra, Probability and Statistics.

Objectives:
1. To create awareness and educate consumers on access to financial services.
2. To make the students understand the basic concepts, definitions and terms related to direct taxation.
3. To help the students compute the Goods and Service Tax (GST) payable by a supplier after considering the eligible input tax credit.
4. To familarise the students with microfinance for accelerating the expansion of local microbusinesses.

Outcomes: On completion of the course, learner will be able to:
1. Use a framework for financial planning to understand the overall role finances play in his/her personal life.
2. Compute income from salaries, house property, business/profession, capital gains and income from other sources.
3. Compute the amount of CGST, SGST and IGST payable after considering the eligible input tax credit.
4. Understand how Microfinance can help in financial inclusion.

Detailed Syllabus (Unit wise)		
Unit	Description	Duration in Hours
01	**Overview of Indian Financial System:** Characteristics, Components and Functions of Financial System. Financial Instruments and Financial Markets, Financial inclusion. **Introduction to Personal Finance** Person Financial Planning in Action, Money Management Skills, Taxes in Your Financial Plan, Savings and Payment Services. Consumer Credit: Advantages, Disadvantages, Sources and Costs.	07
02	**Personal Financial Management** **Loans:** Home, Car, Education, Personal, Loan against property and Jewel loan. **Insurance:** Types of Insurance – ULIP and Term; Health and Disability Income Insurance, Life Insurance. **Investment:** Investing Basics and Evaluating Bonds, Investing in Stocks and Investing in Mutual Funds, Planning for the Future.	07
03	**Income Tax** **Income Tax Act Basics**- Introduction to Income Tax Act, 1961 **Heads of Income and Computation of Total Income and Tax Liability-** Heads of Income and Computation of Total Income under various heads, Clubbing Provisions, Set off and Carry forward of Losses, Deductions, Assessment of Income and tax liability of different persons. **Tax Management, Administrative Procedures and ICDS -** TDS, TCS and Advance Tax Administrative Procedures, ICDS.	08
04	**Goods and Services Tax** GST Constitutional framework of Indirect Taxes before GST (Taxation Powers of Union & State Government); Concept of VAT: Meaning, Variants and Methods; Major Defects in the structure of Indirect Taxes prior to GST; Rationale for GST; Structure of GST (SGST, CGST, UTGST & IGST); GST Council, GST Network, State Compensation Mechanism, Registration. **Levy and Collection of GST** Taxable event- "Supply" of Goods and Services; Place of Supply: Within state, Interstate, Import and Export; Time of supply: Valuation for GST- Valuation rules, taxability of reimbursement of expenses; Exemption from GST: Small supplies and Composition Scheme: Classification of Goods and Services	10
05	**Introduction to Micro – finance** Micro-Finance: Definitions, Scope & Assumptions, Types of Microfinance, Customers of Micro-finance, Credit Delivery Methodologies, SHG concept, origin, Formation & Operation of Self Help Groups (SHGs). **Models in Microfinance -** Joint Liability Groups (JLG), SHG Bank Linkage Model and GRAMEEN Model: Achievements & Challenges, **Institutional Mechanism** Current Challenges for Microfinance, Microfinance Institutions (MFIs): Constraints & Governance Issues, Institutional Structure of Microfinance in India :NGO-MFIs, NBFC-MFIs, Co-operatives, Banks, Microfinance Networks and Associations; Demand & Supply of Microfinance Services in India, Impact assessment and social assessments of MFIs,	10

Books Recommended:

Reference Books:
1. Banking and Financial Sector Reforms in India , by Asha Singh, M.S. Gupta, Serials Publication.
2. Indian Banking Sector: Essays and Issues (1st) , by M.S. Gupta & J.B. Singh, Serials Publication.
3. Basics Of Banking & Finance , by K.M. Bhattacharya O.P. Agarwal , Himalaya Publishing House
4. Agricultural Finance And Management, by S. Subba Reddy , P. Raghu Ram .
5. The Indian Financial System And Development , by Dr.Vasant Desai, Himalaya Publishing House; Fourth Edition
6. Income Tax Management , Simple Way of Tax Management, Tax Planning and Tax Saving , By Sanjay Kumar Satapathy
7. Direct Tax System Income Tax by Dr. R. K. Jain, SBPD Publications.
8. Simplified Approach to GST Goods and Services Tax, By S K Mishra , Educreation Publishing.
9. Introduction To Microfinance , By Todd A Watkins , World Scientific Publishing Company

Evaluation Scheme:
Semester End Examination (A):
Theory:
1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):
Theory:
1. Consisting **One Class Tests for 25 marks** based on approximately 50% of contents and one case study with presentations for 25 Marks.
2. Total duration allotted for writing test paper is 1 hr.
3. Average of the marks scored in the tests and case study will be considered for final grading.

Program: Final Year (Common for All Programs)						Semester: VII			
Course: Energy Audit and Management						Course Code: DJ19ILO7016			
Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)		Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory		Term Test 1	Term Test 2	Avg.	
				75		25	25	25	100
				Laboratory Examination			Term work		Total Term work
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	--
				--	--	--	--	--	--

Objectives:

1. To understand the importance of energy security for sustainable development and the fundamentals of energy conservation.
2. To identify and describe the basic principles and methodologies adopted in energy audit of a utility
3. To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management.
4. To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.

Outcomes: On completion of the course, learner will be able to:

1. To identify and describe present state of energy security and its importance.
2. To identify and describe the basic principles and methodologies adopted in energy audit of a utility.
3. To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.
4. To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities.
5. To analyze the data collected during performance evaluation and recommend energy saving measures.

Syllabus for Final Year of B.Tech. (Common for All Programs)
Semester VII (Autonomous)
(Academic Year 2022-2023)

Unit	Description	Duration in Hours
	Detailed Syllabus (Unit wise)	
01	**Energy Scenario:** Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security, Energy Conservation and its Importance, Energy Conservation Act-2001 and its Features. Basics of Energy and its various forms, Material and Energy balance.	05
02	**Energy Audit:** Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. Elements of monitoring & targeting, Energy audit instruments. Technical and economic feasibility, Classification of energy conservation measures. Safety considerations during energy audit. **Financial analysis techniques:** Simple payback period, NPV, Return on investment (ROI) Internal rate of return (IRR).	10
03	**Energy Management and Energy Conservation in Electrical System:** Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipments and appliances, star ratings. Energy efficiency measures in lighting system, lighting control: Occupancy sensors, daylight integration, and use of intelligent controllers. Energy conservation opportunities in water pumps, compressor, fan and blower. industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.	10
04	**Energy Management and Energy Conservation in Thermal Systems:** Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Steam leakages, Steam trapping, Condensate and flash steam recovery system. Waste heat recovery, use of insulation- types and application. Energy conservation opportunities in: Boiler system. Refrigeration system and HVAC system.	10
05	**Energy conservation in Buildings**: Energy Conservation Building Codes (ECBC): Green Building, LEED rating, Application of Non-Conventional and Renewable Energy Sources, Energy sources and energy management in electric vehicles.	07

Books Recommended:

Reference Books:
1. Handbook of Electrical Installation Practice, Geofry Stokes, Blackwell Science.
2. Designing with light: Lighting Handbook, By Anil Valia, Lighting System.
3. Energy Management Handbook, By W.C. Turner, John Wiley and Sons.
4. Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata Energy Research Institute (TERI).
5. Energy Management Principles, C.B. Smith, Pergamon Press.
6. Energy Conservation Guidebook, Dale R. Patrick, S. Fardo, Ray E. Richardson, Fairmont Press.
7. Handbook of Energy Audits, Albert Thumann, W. J. Younger, T. Niehus, CRC Press.
8. *www.energymanagertraining.com*
9. *www.bee-india.nic.in*

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Consisting of **Two Compulsory Class Tests for 25 marks**, First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I)
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the tests will be considered for final grading.

Program: Final Year (Common for All Programs)						Semester: VII			
Course: Disaster Management and Mitigation Measures						Course Code: DJ19ILO7017			

Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)		Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory		Term Test 1	Term Test 2	Avg.	
				75		25	25	25	100
				Laboratory Examination			Term work		Total Term work
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	--
				--	--	--	--	--	--

Objectives:
1. To provide basic understanding hazards, disaster and various types and categories of disaster occurring around the world.
2. To identify extent and damaging capacity of a disaster.
3. To study and understand the means of losses and methods to overcome /minimize it.
4. To understand roles and responsibilities of individual and various organization during and after disaster.
5. To appreciate the significance of GIS, GPS in the field of disaster management.
6. To understand the emergency government response structures before, during and after disaster.

Outcomes: On completion of the course, learner will be able to:
1. Know natural as well as manmade disaster and their extent and possible effects on the economy.
2. Know the institutional framework and organization structure in India for disaster management and get acquainted with government policies, acts and various emergency laws.
3. Get to know the simple dos and don'ts in such extreme events and build skills to respond accordingly.
4. Understand the importance of disaster prevention and various mitigation measure with the exposure to disasters hotspots across the globe.

Syllabus for Final Year of B.Tech. (Common for All Programs)
Semester VII (Autonomous)
(Academic Year 2022-2023)

	Detailed Syllabus (Unit wise)	
Unit	Description	Duration in Hours
1	**General Information about Disaster:** Brief concept of Hazards, definition and types of Disasters – Natural, Man-made, and hybrid, Groups of Disasters- Natural and Technological, global Scenario, Significance of studying various aspects of disasters, effects of disasters, India's vulnerability to disasters, Impact of disaster on National development. Study of Natural disasters: Flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion etc. Study of Human/Technology Induced Disasters: Chemical, Industrial and Nuclear disasters, Internally displaced persons, road and train accidents Fire Hazards, terrorism, militancy, Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.	10
2	**Disaster Management:** Brief Introduction, Disaster management cycle, Evolution of Disaster and Disaster management in India, Disaster management acts, policies and guidelines, laws of emergencies etc. Prior, During and Post disaster management activities: (Preparedness, strengthening emergency centers, Logistics, optimum resource management, emergency response and relief, Training, Public awareness, Research, Reconstruction of essential services and livelihood restoration.	08
3	**Institutional framework and Mechanism for disaster management in India:** Institutions in India for dealing with various disasters, Organizational structure, functions and responsibilities of National Institute of Disaster Management (NIDM) and National disaster management authority (NDMA) in India, roles and responsibilities of central and state government during and after disaster, NGO's involved in disasters and their task, Jobs carried out by armed forces. Financial Relief During disaster (State, National and International Disaster Assistance)	08
4	**Disaster risk reduction and Mitigation Measures:** Need of disaster prevention and mitigation, mitigation guiding principles, challenging areas, structural and non-structural measures for disaster risk reduction. Mitigation measures for flood, earthquake, cyclone monitoring, air quality, water quality, climate change, land use, winter storms and aquatic biology etc. Use of information management, GIS, GPS and remote sensing Mitigation measure. Do's and don'ts in case of disasters and effective implementation of relief aids.	08
5	**Case studies on disaster (National /International):** Case study discussion of Hiroshima – Nagasaki (Japan), India – Tsunami (2004) , Bhopal gas tragedy, Kerala and Uttarakhand flood disaster, Cyclone Phailin (2013), Fukushima Daiichi nuclear disaster (2011), 26th July 2005 Mumbai flood, Chernobyl meltdown and so on. (Discuss case studies on disaster with respect to reason for the disaster, incidents, effects of disaster, present scenario and safety measures taken)	08

Books Recommended:

Reference Books and Reports:
1. Disaster Management, by Harsh K.Gupta, Universities Press Publications (2003).
2. Disaster Management: An Appraisal of Institutional Mechanisms in India, by O.S.Dagur, published by Centre for land warfare studies, New Delhi, 2011.
3. Introduction to International Disaster Management, by Damon Copolla, Butterworth Heinemann Elsevier Publications (2015).
4. Disaster Management Handbook, by Jack Pinkowski, CRC Press, Taylor and Francis group (2008).
5. Disaster management & rehabilitation, by Rajdeep Dasgupta, Mittal Publications, New Delhi (2007).
6. Natural Hazards and Disaster Management, Vulnerability and Mitigation, by R B Singh, Rawat Publications (2006).
7. Concepts and Techniques of GIS, by C.P.Lo Albert, K.W. Yonng, Prentice Hall (India) Publications (2006).
8. Risk management of natural disasters, by Claudia G. Flores Gonzales, KIT Scientific Publishing (2010).
9. Disaster Management – a disaster manger's handbook, by W. Nick Carter, Asian Development Bank (2008).
10. Disaster Management in India, by R. K. Srivastava, Ministry of Home Affairs, GoI, New Delhi (2011)
11. The Chernobyl Disaster: Legacy and Impact on the Future of Nuclear Energy, by Wil Mara, Marshall Cavendish Corporation, New York, 2011.
12. The Fukushima 2011 Disaster, by Ronald Eisler, Taylor & Francis, Florida, 2013.
    (Learners are expected to refer reports published at national and international level and updated information available on authentic web sites)

Evaluation Scheme:
Semester End Examination (A):
Theory:
1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):
Theory:
1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Program: Final Year (Common for All Programs)							Semester: VII		
Course: Science of Well-being							Course Code: DJ19ILO7018		
Teaching Scheme (Hours / week)				**Evaluation Scheme**					
				Semester End Examination Marks (A)		**Continuous Assessment Marks (B)**			**Total marks (A+ B)**
				Theory		**Term Test 1**	**Term Test 2**	**Avg.**	
Lectures	**Practical**	**Tutorial**	**Total Credits**	**75**		**25**	**25**	**25**	**100**
				Laboratory Examination		**Term work**		**Total Term work**	**--**
3	**--**	**--**	**3**	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**	**Total Term work**
				--	**--**	**--**	**--**	**--**	**--**

Objectives:
1. To create consciousness about importance of holistic health and physical as well as mental well-being.
2. To make learners aware of the concepts of Happiness, Gratitude, Self-Compassion, Empathy etc.
3. To introduce the learners to the means of mental and physical well-being, ill effects of mal-practices like alcoholism, smoking etc.
4. To equip the learners to manage and cope up with stress in their daily living.

Outcomes: Upon Completion of the course, the learner should be able to:
1. Describe concepts of holistic health and well-being, differentiate between its true meaning and misconceptions and understand the benefits of well-being.
2. Recognize meaning of happiness, practice gratitude and self-compassion and analyze incidents from one's own life.
3. Understand the causes and effects of stress, identify reasons for stress in one's own surrounding and self.
4. Recognize the importance of physical health and fitness, assess their life style and come up with limitations or effectiveness.
5. Inspect one's own coping mechanism, assess its effectiveness, develop and strategize for betterment and execute it.

Detailed Syllabus (Unit wise)		
Unit	Description	Duration in Hours
1	**Health and well-being:** The concept of health, dimensions of health, the notion of well-being, various facets of well-being, relation between health and well-being. Concept of holistic health, its principles and importance, concept and benefits of holistic care, misconceptions about holistic health approach, the application of a true holistic approach to our well-being.	06
2	**Concepts of happiness:** Happiness: what is it and how do we measure it? Philosophical perspectives on happiness, Happiness: Nature or Nurture? Happiness in the modern world: impediments and accelerators, Narrow vs. Broad Band Approaches to Happiness, Benefits of Happiness, Self-Compassion and Gratitude. Misconceptions of happiness.	08
3	**Stress and mental health/well-being**: Nature and concept of stress, meaning and definitions of stress, types of stress, meaning of stressors, types of stressors, symptoms of stress, effects of stress, different models of stress. Sources of stress and how does stress cause illness, various sources of stress, delineate between external and internal sources of stress, differentiate between continuous and discrete stressors, the effects of these stressors on health and well-being, diversity of stressors and their health consequences, relation between stress and illness from different perspectives association between stress related physiological mechanisms and different illnesses.	10
4	**Physical Well-being / Health management:** concept of health behaviours, dimensions of health behaviours. Health enhancing behaviors: Exercise and Weight control, application and importance of these health enhancing behaviours. Health protective behaviors and illness management: concept of illness management, effectiveness of illness management. Concept of Nutrition, Role of Nutrition, Components of Nutrition, concept of Malnutrition, Health compromising behaviours: Alcoholism, Smoking and its effects on health.	10
5	**Dealing with Difficult Times / Coping mechanisms:** The concept of chronic stress, Health and safety risks of chronic stress, Forms and Treatment of chronic stress, Coping with Acute and Chronic stress, theories of the stress-illness link, role of stress in mental disorders. Concept of coping, Ways of coping and stress management, basic knowledge about stress management, various techniques of stress management, stress management programs. Mental strengths and virtues, Hope, Optimism, Resilience – concept, pathways and models, Meditation and Self-introspection.	08

Books Recommended:

Textbooks:
1. The Science of well-being by Felicia Huppert, Nick Baylis, Barry Keverne; Oxford University Press
2. Health and Well-Being: Emerging Trends by S. Ojha, U. Rani Srivastava, Shobhna Joshi, Global Vision Publishing House
3. Positive psychology: The scientific and practical explorations of human strengths by Shane J. Lopez, Jennifer Teramoto Pedrotti, Charles Richard Snyder; Sage Publications.

Reference Books:
1. The pursuit of happiness and the realization of sympathy: Cultural patterns of self, social relations, and well-being by Kitayama, S., & Markus, H. R, Culture and subjective well-being, The MIT Press.
2. Man Adapting by Dubos, R; New Haven: Yale University Press.
3. Happiness a history by McMahon D. M., Atlantic Monthly Press.
4. Well-being: The foundations of hedonic psychology by D. Kahneman & E. Diener & N. Schwarz, New York: Russell Sage
5. Selye H. The Stress of Life. New York; McGraw-Hill; 1984.

Evaluation Scheme:
Semester End Examination (A):
Theory:
1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):
Theory:
1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Syllabus for Final Year of B.Tech. Program in Mechanical Engineering:
Semester VII (Autonomous)
(Academic Year 2022-2023)

Program: Final Year Mechanical Engineering						Semester: VII				
Course: Research Methodology						Course Code: DJ19ILO7019				
Teaching Scheme (Hours / week)				**Evaluation Scheme**						
				Semester End Examination Marks (A)	**Continuous Assessment Marks (B)**					**Total marks (A+ B)**
				Theory	**Term Test 1**	**Term Test 2**	**Avg.**			
Lectures	Practical	Tutorial	Total Credits	75	25	25	25			100
				Laboratory Examination			**Term work**			**Total Term work**
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	Total Term work	--
				--	--	--	--	--	--	

Pre-requisites: Basic Knowledge of Probability and Statistics.

Objectives:
1. To understand Research and Research Process
2. To acquaint learners with identifying problems for research and develop research strategies
3. To familiarize learners with the techniques of data collection, analysis of data and interpretation

Outcomes: On completion of the course, learner will be able to:
1. Prepare a preliminary research design for projects in their subject matter areas
2. Accurately collect, analyze and report data
3. Present complex data or situations clearly
4. Review and analyze research findings
5. Write report about findings of research carried out

Detailed Syllabus (Unit wise)		
Unit	**Description**	**Duration in Hours**
1	**Basic Research Concepts** Meaning of research, Objectives of research, Types of research, Significance of research Research process	07
2	**Research Methodology:** Identification of research problem, Literature review, Formulation of hypothesis, Formulation of Research design.	10
3	**Research and Sample Design:** Meaning of research and sample design, Need of research design, Features of good research design, Important concepts, Different research designs, Types of sampling designs	10
4	**Data Collection and Data Analysis:** Types of data, Methods for collecting data: Experiments and surveys, Collection of primary and secondary data, Hypothesis testing and interpretation of Data	10
5	**Interpretation and Report Writing:** Interpretation and drawing conclusions on the research, Preparation of the report, Ethical Issues	05

Books Recommended:

Reference Books:
   1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers
      Distributors.
   2. Kothari, C.R.,1985, Research Methodology-Methods and Techniques, New Delhi, Wiley
      Eastern Limited.
   3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nd Edition),
      Singapore, Pearson Education

Evaluation Scheme:
Semester End Examination (A):
Theory:
1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but
   with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):
Theory:
1. Two term tests of 25 marks each will be conducted during the semester out of which; one will
   be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or
   an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Program: Final Year (Common for All Programs)					Semester: VII				
Course: Public Systems and Policies					Course Code: DJ19ILO7020				
Teaching Scheme (Hours / week)					Evaluation Scheme				
					Semester End Examination Marks (A)	Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits		Theory	Term Test 1	Term Test 2	Avg.	
					75	25	25	25	100
					Laboratory Examination	Term work		Total Term work	
3	--	--	3		Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	
					--	--	--	--	--	--

Pre-requisites: Basic Knowledge of Social science and Current affairs

Objectives:
1. To analyze the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.
2. To understand public systems in a fast-changing environment in the global context.
3. To provide an in-depth understanding of the ills prevailing in the society and aids to identify the solutions for them.
4. To explain public policy and its operations with special focus on policy relating to Government finance.
5. To analyze and evaluate the impact of the public policy on firms and economy at large.

Outcomes: On completion of the course, learner will be able to:
1. Understand the importance of public systems in a fast-changing environment in the global context.
2. Analyze the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.
3. Explain public policy and its operations with special focus on policy relating to Government finance.
4. Make policies and know about the happenings in the world, in the nation and those in their locality.
5. Analyze and evaluate the impact of the public policy on firms and economy at large and work under various fields as policymakers.

	Detailed Syllabus (Unit wise)	
Unit	**Description**	**Duration in Hours**
1	**Introduction and Overview of Public Systems:** Ideology of Public Systems; Mechanistic and Organic view of Society and Individuals, The Legal Framework; Federal Government; State and Local Governments, Government growth; The size of Government.	10
2	**Public Sector in the Economics Accounts:** Public Sector in the circular flow; Public Sector in the National Income Accounts.	6
3	**Public Choice and Fiscal Politics:** Direct Democracy; Representative Democracy; The Allocation Function; The Distribution Function; The Stabilization Function; Coordination of Budget Functions; The Leviathan Hypothesis.	8
4	**Introduction and Overview of Public Policy:** Markets and Government; Social goods and Market failure, Public expenditure and its evaluation; Cost Benefit Analysis, Public policy and Externalities, Taxation Policy and its impact, Income distribution, redistribution and social security issues Fiscal & Budgetary Policy, Fiscal Federalism in India.	12
5	**Case Studies in Expenditure Policy: Public Services** A) National Defense B) Highways C) Outdoor Recreation D) Education	6

Books Recommended:

Reference Books:
1. Introduction to Public Policy by Charles Wheelan, W.W. Norton & Company.
2. Understanding Public Policy by Thomas R. Dye, Prentice Hall.
3. Public Policy-Making: An Introduction by Anderson J.E., Boston, Houghton.
4. Public Administration by Avasthi & Maheshwari, Lakshminarayan Agarwal, Agra.
5. New Horizons of Public Administration by Bhattacharya, Mohit, Jawahar Publishers, New Delhi.
6. Public Administration and Public Affairs by Henry, Nicholas, Prentice Hall of India, New Delhi.
7. Public Finance 10th Edition by Harvey S Rosen and Ted Gayer, McGraw-Hill Education, 2013.
8. Public Finance in Theory and Practice by Musgrave and Musgrave.

Evaluation Scheme:
Semester End Examination (A):
Theory:
1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester, out of which one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.

Program: Final Year Electronics Engineering								Semester: VII	
Course: Skill Based Laboratory - III								Course Code: DJ19ELXSBL3	

Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)		Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory		Term Test 1	Term Test 2	Avg.	
				--		--	--	--	--
				Laboratory Examination			Term work		
-	4	--	2	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	Total Term work
				--	--	50	10	15	25	75

Pre-requisite: Knowledge of
1. Skill Based Laboratory - I
2. Skill Based Laboratory - II.

Objectives:
1. To understand architecture and working of IoT ready DIY boards.
2. To gain knowledge and skills related to 3D printing technologies.

Outcomes: On completion of the course, learner will be able to:
1. Demonstrate working of IoT ready DIY board like LoRa ESP32 and Raspberry Pi for providing task-based solution
2. Demonstrate understanding of open-source 3D modeling tool Blender.
3. Fabricate the designed objects using 3D printer.

The main intention of Skill Based Laboratory is to motivate and enable students to apply knowledge and skills acquired out of courses studied to solve and implement solutions to practical problems. Under the program structure students do undergo various theory, laboratory and tutorial courses in which they do experimentation based on the curriculum requirements. Skill based laboratory is expected to go beyond the scope of curriculum of courses. Activities of, practical societal problem-solutions, by involving in group activities are expected to enrich student-skills in the areas of modern tool usage, team building & team-work and ethics along-with effective skill of communication.

Content/Coverage expected:

- Use of Open-source tools for designing of 3D Models.
- Understanding process and methodology for converting modeled objects into physical entities.
- Architecture, specifications and features of modules: LoRa ESP32 and SBC – Raspberry-pi.

Recommended tasks/projects:

3D Printing:
Familiarise with open-source tool - 'blender'; Creating 3D objects such as cube, solenoid etc.; Convert file to desired format suitable for 3D printing; Fabricate objects using 3D printer.

DIY Boards:
Evaluate IoT ready board LoRa ESP32 and SBC – Raspberry Pi for basic functionality and implement identified tasks: Interfacing with GPIOs includes digital inputs and outputs, analog inputs, pulse width modulation.
Build simple web server that control ESP32 outputs, send sensor readings via Email (IFTTT), make API requests to access data. Send and receive LoRa packets (point to point communication). Install the Mosquitto Broker on a Raspberry Pi, use MQTT to exchange data between two ESP32 boards.

Recommended Resources:
Books:
1. Raspberry Pi User Guide, 4th Edition: Eben Upton, Gareth Halfacree. (Wiley)

Web Resources:
1. Blender Tutorial: Spoken Tutorial Project, IIT Bombay. [online] Available at: < https://spoken-tutorial.org/tutorial-search/?search_foss=Blender&search_language=English> [Accessed 26 October 2021].

Evaluation Scheme:

Group comprising of not more than maximum **three** (03) students is recommended for this course. Each group shall keep proper assessment record of progress of the project and at the end of the semester it should be assessed for awarding TW marks. The final examination will be based on demonstration in front of internal and external examiner. In the examination each individual student shall be assessed for her/his contribution, understanding and knowledge gained about the task completed.

Prof. Vivek Nar	Dr. Prasad Joshi	Dr. Prasad Joshi	Dr. Hari Vasudevan
Prepared by	Checked by	Head of the Department	Principal

Program: Final Year Electronics Engineering								Semester : VII		
Course : Project - I								Course Code: DELXP704		
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				--			--	--	--	--
				Laboratory Examination			Term work			
--	6	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation / Journal	Total Term work	100
				--	--	50	50	--	50	

Objectives:

1. To acquaint with the process of undertaking literature survey/industrial visit and identifying the problem
2. To familiarize the process of problem solving in a group
3. To acquaint with the process of applying basic engineering fundamentals in the domain of practical applications
4. To inculcate the process of research Outcomes

Outcomes:

1. Do literature survey/industrial visit and identify the problem
2. Apply basic engineering fundamental in the domain of practical applications
3. Cultivate the habit of working in a team
4. Attempt a problem solution in a right approach
5. Correlate the theoretical and experimental/simulations results and draw the proper inferences
6. Prepare report as per the standard guidelines.

Guidelines for Assessment of Project I

Project I should be assessed based on following points

1. Quality of problem selected, Clarity of Problem Definition & Feasibility of problem solution
2. Relevance to the specialization / Industrial trends & Clarity of objective and scope
3. Quality of work attempted & Validation of results
4. Quality of Written and Oral Presentation

Project Report has to be prepared strictly as per University of Mumbai report writing guidelines.

Dr. Mrunal Rane	Prof. Rashmi Ravikumar	Dr. Prasad Joshi	Dr. Hari Vasudevan
Prepared by	Checked by	Head of the Department	Principal

Program: Fourth Year Electronics Engineering								Semester : VIII		
Course : Robotics and Industrial Automation								Course Code: DJ19ELXC801		
Course : Robotics and Industrial Automation Laboratory								Course Code: DJ19ELXL801		
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)		Continuous Assessment Marks (B)				Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory		Term Test 1	Term Test 2	Avg.		
				75		25	25	25		100
				Laboratory Examination			Term work			
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	Total Term work	50
				25	--	--	10	15	25	

Pre-requisite: Knowledge of
1. Applied and Advanced Engineering Mathematics
2. Design with Linear Integrated Circuits
3. Control system and instrumentation

Objectives:
1. To understand the anatomy of Robots and kinematics for industrial applications.
2. To understand various types of controllers used in process and their tuning for different applications.

Outcomes: On completion of the course, learner will be able to:

1. To understand various robot parameters and its applications.
2. To apply knowledge of D-H algorithms for robot model representation
3. To analyze kinematics of robots.
4. Distinguish different path and trajectory.
5. Analyze the controller parameters for discrete or continuous type
6. Design the process controller (electronic) for a given process or application

Detailed Syllabus: (unit wise)		
Unit	Description	Duration
1	**Fundamentals of Robotics:** 1.1 Robot Classification, Robot Components, Robot Specification, Joints, Coordinates, Coordinate frames, Workspace, Applications.	04

2	**Kinematics of Robots:**	08
	2.1 Homogeneous transformation matrices, Inverse transformation matrices, Forward and inverse kinematic equations – position and orientation.	
	2.2 Denavit - Hartenberg representation of forward kinematics, Forward and inverse kinematic solutions of SCARA robot.	
3	**Trajectory planning:**	04
	3.1 Basics of Trajectory planning, Joint-space trajectory planning, Cartesian-space trajectories	
4	**Analog & digital signal conditioning and Instrumentation Circuits:**	10
	4.1 Signal level & bias change, linearization, conversion, filtering & impedance matching, concept of loading, comparators & converters	
	4.2 Design of operational amplifier based circuits in instrumentation – analysis of voltage divider circuits, bridge circuits, inverting & non-inverting amplifier, instrumentation amplifier, V to I & I to V converter, integrator, differentiator & linearization.	
	4.3 Transmitters – Introduction to telemetry & its basic block diagram, 2 wire, 3 wire & 4 wire transmitters, 4 mA to 20 mA current transmitter, current to pressure (I to P) & pressure to current (P to I) converters.	
5	**Controllers Discontinuous & Continuous and Tuning:**	08
	3.1 Two position discontinuous control mode.	
	3.2 Continuous control mode – single mode (P, I & D) & composite mode (PD, PI & PID), selection criterion of controller for a process mode	
	3.3 Tuning of PID controller – open loop transient response method, Ziegler – Nichols tuning method, frequency response method.	
6	**Discrete state process controller:**	08
	4.1 Discrete state process variables, specifications & event sequence description	
	4.2 Relay controller, ladder diagram logic, ladder diagram elements & ladder diagram programming examples	
	4.3 PLC – relay sequencers, programmable logic controller design, PLC operation, programming the PLC.	
	4.4 HMI and SCADA.	
	Total hours	**42**

Suggested List of Experiments:
(*However Instructor is free to design his/her own experiments as per the guidelines*)

Laboratory Experiments: (Any seven)

1. Forward kinematics
2. Inverse kinematic
3. Dynamic analysis
4. Joint-space trajectory
5. Cartesian-space trajectory
6. Design of stepper motor interface & controller
7. Design of instrumentation amplifier for variable voltage gain
8. Design of signal conditioning circuits for LDR / thermistor / RTD / strain gauge
9. Tuning of P+I+D controller using MATLAB / Simulink
10. Implementation of PLC ladder diagram for given application

Seminars on Actuators – Electrical, Pneumatic and Hydraulic on the following content:

S.1 Electrical actuators – relays, solenoids & electrical motors (DC, AC & stepper motor)

S.2 Pneumatic actuators – basic pneumatic system, pneumatic compressors (piston, vane, screw) flapper nozzle, single & double acting cylinder, rotary actuator, filter-regulator-lubricator (FRL)

S.3 Hydraulic actuator – hydraulic pumps, control valves types (globe, ball, needle, butterfly, gate, diaphragm & pinch), cavitation & flashing with their remedies, pressure drop across valve & leakage, valve noise, flow characteristics on load changes, control valves parameters, control valves sizing, valve calibration, digital control valves, selecting control valves & applications

Books Recommended:

Textbooks:
1. Robert Shilling, "Fundamentals of Robotics - Analysis and contro"l, Prentice Hall of India, 2009.
2. Saeed Benjamin Niku, "Introduction to Robotics – Analysis, Control, Applications", Wiley India Pvt. Ltd., Second Edition, 2011
3. Curtis D. Johnson, Process Control Instrumentation Technology, 7th edition, PHI

Reference Books:
1. John J. Craig, "Introduction to Robotics – Mechanics & Control", Third Edition, Pearson Education, India, 2009
2. Mark W. Spong , Seth Hutchinson, M. Vidyasagar, "Robot Modeling & Control ", Wiley India Pvt. Ltd., 2006
3. S. K. Singh, Industrial Instrumentation & Control, 3rd edition, McGraw Hill
4. B.C. Nakra & K. K. Chaudhary, Instrumentation Measurement & Analysis, 3rd edition, McGraw Hill
5. Andrew Parr, Pneumatics & Hydraulics, 2nd edition, Jaico Publishing Co.
6. B. G. Liptak, Handbook of Process Control & Instrumentation, 4th edition, CRC Press

Evaluation Scheme:

Semester End Examination (A):

Theory:
1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:
1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:
1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)
Term work shall consist of minimum 7 experiments, 1 Seminar and minimum 2 assignments.

The distribution of marks for term work shall be as follows:

Laboratory work:	15 Marks
Assignment/Quiz:	10 Marks
Total:	**25 Marks**

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prof. Sheeja Nair	Dr. Prasad Joshi	Dr. Prasad Joshi	Dr. Hari Vasudevan
Prepared by	Checked by	Head of the Department	Principal

Program: Fourth Year Electronics Engineering								Semester: VIII	
Course: Digital Image Processing								Course Code: DJ19ELXC802	
Course: Digital Image Processing Laboratory								Course Code: DJ19ELXL802	

Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)		Continuous Assessment Marks (B)			Total marks (A+ B)
				Theory		Term Test 1	Term Test 2	Avg.	
Lectures	Practical	Tutorial	Total Credits	75		25	25	25	100
				Laboratory Examination		Term work			
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	Total Term work	50
				25	--	--	15	10	25	

Pre-requisite: Knowledge of
1. Advanced Engineering Mathematics
2. Digital Signal Processing

Objectives:
1. To learn the fundamental concepts of Digital Image Processing.
2. To understand basic image enhancement and segmentation techniques.
3. To illustrate Image Transform calculations mathematically and develop fast transform algorithm
4. To learn Image Compression Techniques

Outcomes: On completion of the course, learner will be able to:
1. Illustrate & make use of the fundamental concepts and basic elements of digital image processing.
2. Apply image enhancement in spatial domain, frequency domain and using histogram modeling.
3. Apply different image segmentation and representation techniques on images.
4. Examine different morphological operations used in binary image processing.
5. Analyze image in frequency domain through different transforms.
6. Analyze different image compression techniques.

Detailed Syllabus: (unit wise)		
Unit	Description	Duration
1	**Digital Image Processing Fundamentals** 1.1 Introduction: Digital Image Representation, Fundamental Steps in Image Processing, Elements of a Digital Image Processing System	06

	1.2 Digital Image Fundamentals: Sampling and Quantization, Some Basic Relationships between Pixels. Image File Formats: BMP, TIFF, PNG, GIF and JPEG, Colour Models (RGB, HSI, YUV)	
2	**Image Enhancement** 2.1 Spatial Domain Methods, Frequency Domain Methods, Some Simple Intensity Transformations, Histogram Processing. 2.2 Smoothing Filters, Sharpening Filters, Generation of Spatial Masks from Frequency Domain Specifications, Homomorphic Filtering.	12
3	**Image Segmentation and Representation** 3.1 Detection of Discontinuities, Edge Linking using Hough Transform, Thresholding, Region based Segmentation, Split and Merge Technique 3.2 Image Representation and Description: Chain Code, Polygonal Representation, Moments	10
4	**Binary Image Processing** Binary Morphological Operators, Hit-or-Miss Transformation, Boundary Extraction, Region Filling, Thinning and Thickening	04
5	**Image Transform** 5.1 Introduction to two-dimensional Discrete Fourier Transform, Some Properties of the Two-Dimensional Fourier Transform, Fast Fourier Transform (FFT). 5.2 Hadamard Transform, Discrete Cosine Transform (DCT), Discrete Wavelet Transform (DWT)	04
6	**Image Compression:** 6.1 Fundamentals – Coding Redundancy, Interpixel Redundancy, Psychovisual Redundancy, Fidelity Criteria. 6.2 Image Compression Models – The Source Encoder and Decoder, Lossless Compression Techniques: Run Length Coding, Arithmetic Coding, Huffman Coding 6.3 Lossy Compression Techniques: Improved Gray Scale Quantization, Vector Quantization, JPEG, MPEG.	06
	Total hours	42

Suggested List of Experiments:
(*However Instructor is free to design his/her own experiments as per the guidelines*)

Laboratory Experiments: (Any seven)
1. Point Processing Operations
2. Bit Plane Slicing & Watermarking
3. Neighborhood Processing
4. Histogram Processing
5. Image segmentation based on discontinuity
6. Region based image segmentation
7. Morphological Operations
8. Image Transform
9. Image Compression

Books Recommended:

Textbooks:

1. Rafel C. Gonzalez and Richard E. Woods, 'Digital Image Processing', Pearson Education Asia, 3rd Edition,2009
2. Anil K. Jain, "Fundamentals and Digital Image Processing", Prentice Hall of India, 3rd Edition

Reference Books:

1. S. Jayaraman, E. Esakkirajan and T. Veerkumar, "Digital Image Processing" Tata McGraw Hill, 2009
2. Milan Sonka, Vaclav Hlavac, and Roger Boyle, "Image Processing, Analysis, and Machine Vision", Second Edition, Thomson Learning, 2001
3. William K. Pratt, "Digital Image Processing", Third Edition, John Wiley & Sons, Inc., 2001

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practical performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 8 experiments and 1 Power Point Presentation.

The distribution of marks for term work shall be as follows:

Laboratory work:	15 Marks
Presentation:	10 Marks
Total:	**25 Marks**

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prof. Sejal Kadam	Dr. Prasad Joshi	Dr. Prasad Joshi	Dr. Hari Vasudevan
Prepared by	Checked by	Head of the Department	Principal

Program: Final Year B.Tech. (Electronics Engineering)							Semester : VIII		
Course: IC and Bio-MEMS Technology							Course Code: DJ19ELEC8041		
Course: IC and Bio-MEMS Technology Laboratory							Course Code: DJ19ELEL8041		
Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)		Total marks (A+ B)
Lectures	Practical	Tut.	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial/ Mini project/ presentation/ Journal		50
				25	--	--	15	10	25	

Pre-requisite courses:
- DJ19ELXC302: Electronic Devices and Circuits I
- DJ19ELXC304: Digital Circuit Design
- DJ19ELXC603: VLSI Design
- Knowledge of working of transducers used in medical applications

Objectives:
1. To provide knowledge of IC fabrication processes and advanced IC technologies.
2. To apply the knowledge of MEMS in Biomedical field
3. To understand recent advancements in the area of micro and nanotechnology with reference to biomedical field

Outcomes: On completion of the course, learner will be able to:
1. Demonstrate a clear understanding of various MOS fabrication processes & CMOS fabrication flow.
2. Develop or modify the MEMS processes for a simple MEMS device in order to reduce the fabrication time.
3. Analyze micro total analysis system with designing of its components
4. Demonstrate working principles of different types of Bio Nano-sensors and drug delivery devices along with their fabrication process.

Detailed Syllabus: (unit wise)		
Unit	Description	Duration
1	**Crystal Growth, Wafer preparation and fabrication for IC Technology** 1.1 Semiconductor Manufacturing - Semiconductor technology trend, clean rooms, wafer cleaning. 1.2 Semiconductor Substrate - Crystal structure, crystal defects, Czochralski growth, wafer preparation and specifications.	04

2	**Fabrication Processes**	10
	2.1 Epitaxy - Classification, molecular beam epitaxy.	
	2.2 Silicon Oxidation - Oxidation process, kinetics of growth, classification (Wet and Dry).	
	2.3 Deposition - Evaporation, sputtering, APCVD	
	2.4 Diffusion & Ion Implantation - Nature of diffusion, diffusion in a concentration gradient, diffusion system, ion implantation system.	
	2.5 Etching - Basic concepts and classification.	
	2.6 Lithography - Introduction to lithography process, types of photoresist, photolithography.	
	2.7 Metallization and Contacts - Introduction to metallization, Schottky contacts and ohmic contacts.	
	2.8 CMOS Process Flow - N well and twin tub process.	
3	**Introduction to Bio-MEMS**	04
	3.1 Introduction to MEMS, comparison with IC Technology, comparison of MEMS and Bio-MEMS, block diagram of Bio-MEMS and examples.	
	3.2 Materials - Properties and applications of silicon, SiO_2, PSG, Quartz, Silicon Nitride, Silicon Carbide, Germanium, Diamond, GaAs, Polymers (PMMA, PDMS, SU8), Al, Tungsten, Nitinol, Glass, Piezoelectric materials.	
4	**Microfabrication and Packaging Techniques**	08
	4.1 Bulk micromachining - definition, advantages and disadvantages, Examples: pressure sensor, dissolved wafer process, CO_2 sensor	
	4.2 Surface micromachining - definition, advantages and disadvantages, Examples: pressure sensor, cantilever, Non polysilicon surface micromachining-SOI fabrication	
	4.3 LIGA - definition, process steps, examples, advantages and disadvantages, molding techniques: injection, compression, hot embossing	
	4.4 Micro moulding techniques - replica molding, microtransfer molding, micromoulding in capillaries and solvent-assisted micromoulding.	
	4.5 Packaging technologies - die preparation, surface bonding, wire bonding, sealing.	
5	**Micro Total Analysis Systems (µTAS)**	08
	5.1 Microfluidics - basic block diagram, flow techniques in microfluidics: pressure driven force, electro- osmosis, electro-phoresis.	
	5.2 Micropumps, microvalves, microchannels, microheaters - types and fabrication	
	5.3 Separation techniques - capillary electrophoresis, electrochromatography, Isoelectric focusing	
	5.4 Detection techniques - electrochemical detection, fluorescence, chemiluminescence	
6	**Micro/ Nano Biosensors and Drug Delivery Devices**	08
	6.1 Biosensor - definition, block diagram	
	6.2 Classification (based on detection technique) - electric, magnetic, optical, thermal, mechanical, and chemical	
	6.3 Development of biosensors (Basic steps) - surface modification, immobilization, integration with transducer, cantilever for antibody detection	
	6.4 Drug delivery - Techniques, profiles, vehicles for drug delivery, nanoparticles for drug delivery and micro needles.	
	Total hours	**42**

Suggested List of Experiments:
(However Instructor is free to design his/her own experiments as per the guidelines)

Laboratory Experiments: (Any seven)
1. Simulate oxidation process with Deal-Grove model for different conditions (e.g. oxidation type, orientation, time, temperature, thickness etc.) and comment on the results obtained.
2. Simulate diffusion process for different conditions (e.g. source, time, temperature, dopant etc.) and comment on the results obtained.
3. Micromachined piezoresistive pressure sensor
4. Micromachined Accelerometer Sensor
5. Temperature Measurement of Heated Membrane using microheater
6. Temperature Response of heated membrane to Standard Analog Inputs
7. Temperature Response of heated membrane to customized voltage profiles
8. Differential response of micro heaters to customized voltage profiles
9. Simulation of cantilever (NANOHUB SUGAR)

Books Recommended:
Textbooks:
1. James D. Plummer, Michael D. Deal and Peter B. Griffin, "Silicon VLSI Technology", Pearson, Indian Edition.
2. Sorab K. Gandhi, "VLSI Fabrication Principles", Wiley, Student Edition.
3. Tai Ran Hsu, "MEMS and Microsystems Design and Manufacture", McGraw Hill Education
4. Marc Madou, "Fundamentals of Microfabrication", CRC Press

Reference Books:
1. N. Maluf, K Williams, "An Introduction to Micro-Electromechanical Systems Engineering", Artech House Inc., Second Edition.
2. G. S. May and S. M. Sze, "Fundamentals of Semiconductor Fabrication", Wiley, First Edition.
3. Steven S. Saliterman, "Fundamentals of BioMEMS and Medical Microdevices", SPIE Press Monograph, Vol. PM153 by Wiley Interscience.

Evaluation Scheme:
Semester End Examination (A):
Theory:
1. Question paper based on the entire syllabus summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:
1. Oral examination will be based on the entire syllabus including, the practical performed during laboratory sessions.

Continuous Assessment (B):
1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in the two tests will be considered for final grading.

Term work:

Term work shall consist of minimum 7 experiments, minimum 2 assignments and 1 research paper review (IEEE, Springer, Elsevier)

The distribution of marks for term work shall be as follows:

Laboratory work:	15 Marks
Assignment/Quiz:	10 Marks
Total:	**25 Marks**

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Dr. Mrunal Rane	Prof. Darshana Sankhe	Dr. Prasad Joshi	Dr. Hari Vasudevan
Prepared by	Checked by	Head of the Department	Principal

Program: Fourth Year Electronics Engineering								Semester: VIII	
Course: Big Data Analytics								Course Code: DJ19ELEC8042	
Course: Big Data Analytics Laboratory								Course Code: DJ19ELEL8042	

Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)		Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory		Term Test 1	Term Test 2	Avg.	
				75		25	25	25	100
				Laboratory Examination		Term work			
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	Total Term work	50
				--	--	25	15	10	25

Pre-requisite: Knowledge of
1. Data Base Management System

Objectives:
1. To Provide an Overview of an exciting growing field of Big Data Analytics.
2. To introduce the tools required to manage and analyze big data like Hadoop, NoSql, Map Reduce.
3. To teach the fundamental techniques in achieving big data analytics with scalability and streaming capability.

Outcomes: On completion of the course, learner will be able to:
1. Understand the key issues in big data management.
2. Acquire fundamental enabling techniques using tools in big data analytics.
3. Achieve adequate perspectives of big data analytics in various applications like sensor, recommender systems, social media applications etc.

Detailed Syllabus: (unit wise)		
Unit	**Description**	**Duration**
1	**Introduction to Big Data Analytics & Hadoop** 1.1 Introduction to Big Data, Big Data characteristics, types of Big Data, Traditional vs. Big Data business approach. 1.2 Technologies Available for Big Data, Infrastructure for Big Data, Big Data Challenges, Case Study of Big Data Solutions. 1.3 Introduction to Hadoop. Core Hadoop Components, Hadoop Ecosystem, Physical Architecture, Hadoop limitations.	06

2	**NoSQL**	08
	2.1 Introduction to NoSQ, NoSQL business drivers, NoSQL case studies.	
	2.2 NoSQL data architecture patterns: Key-value stores, Graph stores, Column family (Bigtable) stores, Document stores, Variations of NoSQL architectural patterns. Analyzing big data with a shared-nothing architecture; Choosing distribution models: master-slave versus peer-to-peer	
	2.3 Introduction to MongoDB, MongoDB commands.	
3	**MapReduce**	08
	3.1 MapReduce and The New Software Stack: Distributed File Systems, Physical Organization of Compute Nodes, Large Scale File-System Organization.	
	3.2 MapReduce: The Map Tasks, Grouping by Key, The Reduce Tasks, Combiners, Details of MapReduce Execution, Coping With Node Failures	
	3.3 Matrix vector multiplication using MapReduce, Case studies on MapReduce using Java/Python	
4	**Techniques in Big Data Analytics**	10
	4.1 Finding Similar Item: Nearest Neighbor Search, Similarity of Documents	
	4.2 Mining Data Streams: Data Stream Management Systems, Data Stream Model, Examples of Data Stream Applications: Sensor Networks, Network Traffic Analysis	
	4.3 Link Analysis: PageRank Definition, Structure of the web, dead ends, Using Page rank in a search engine	
	4.4 Frequent Itemset Mining: Market Basket Model- Applications, Association Rule-Confidence, Interest, Support. Apriori Algorithm - Pass1, Pass2.	
5.	**Big Data Analytics Applications**	10
	5.1 Recommendation Systems: Introduction, A Model for Recommendation Systems, Content based Recommendation System, Collaborative-Filtering System: Nearest Neighbour Technique, Example.	
	5.2 Mining Social-network Graphs: Social Networks as graphs, Types of Social-network, relevance of community detection, Clique Percolation Method.	
	Total hours	42

Suggested List of Experiments:
(*However Instructor is free to design his/her own experiments as per the guidelines*)
Laboratory Experiments: (Any seven)
1. Case Study on Hadoop Installation
2. Basic commands in MongoDB
3. Querying in MongoDB
4. PIG SCRIPTING
5. HIVE SCRIPTING
6. Matrix Multiplication Using MapReduce
7. Word Count using MapReduce
8. Case Study on Recommendation Systems

Books Recommended:
Textbooks:
1. Radha Shankarmani and M Vijayalakshmi ―Big Data Analytics‖, Wiley
2. Alex Holmes ―Hadoop in Practice‖, Manning Press, Dreamtech Press.
3. Dan McCreary and Ann Kelly ―Making Sense of NoSQL‖ – A guide for managers and the rest of us, Manning Press.

Reference Books:

1. Bill Franks , ―Taming The Big Data Tidal Wave: Finding Opportunities In Huge Data Streams With Advanced Analytics‖, Wiley
2. Chuck Lam, ―Hadoop in Action‖, Dreamtech Press

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:

1. Oral examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 7 experiments, 1 Power Point Presentation and minimum 2 assignments.

The distribution of marks for term work shall be as follows:

Laboratory work:	15 Marks
Assignment/Quiz:	10 Marks
Total:	**25 Marks**

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prof. Lakshmi Kuroop	**Dr. Vinaya Sawant**	**Dr. Prasad Joshi**	**Dr. Hari Vasudevan**
Prepared by	Checked by	Head of the Department	Principal

Program: Final Year Electronics Engineering								Semester: VIII		
Course: Advanced Networking Technologies								Course Code: DJ19ELEC8043		
Course: Advanced Networking Technologies								Course Code: DJ19ELEC8043		
Teaching Scheme (Hours / week)				Evaluation Scheme						
Teaching Scheme (Hours / week)				Semester End Examination Marks (A)		Continuous Assessment Marks (B)				Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory		Term Test 1	Term Test 2	Avg.		Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	75		25	25	25		100
				Laboratory Examination			Term work			
3	2	--	4	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation / Journal	Total Term work	50
				25	--	--	15	10	25	

Pre-requisite: Knowledge of
1. IoT Enterprise Network
2. Wireless Communication & Digital Communication

Objectives:

The objectives of this course are to:
1. Comprehend & Design a complete Campus/wide network from Access layer to Security
2. Evaluate Interior & Exterior Routing Algorithms & ensure failsafe design implementations
3. Introduce concepts of VPN, MPLS & Software Defined Networks for Emerging Technologies.

Outcomes:

On completion of the course, learner will be able to:
1. Evaluate/ Design Small – Medium Scale Networks from access layer to backbone layer
2. Design for Emerging areas such as Iot and IIoT
3. Migrate designs to new technologies that are high speed-high security-high QoS Networks

Detailed Syllabus: (unit wise)		
Unit	Description	Duration
1	**IP Subnets & Network Design** 1.1 3-Tier Network Design – Access layer, Distribution layer & Backbone layer (User – Service Provider), IP Addressing using IPv4 and IPv6 with Classful & Classless Routing Protocols 1.2 Design using VLANs – IEEE 802.1Q, ISL(Inter-Switch Link), VLAN Trunking Protocol: VTP Server-Client Mode, VTP Transparent Mode & VTP Pruning	10

2	**IP Routing Design**	**14**
	2.1 Distance Vector Routing (Bellman Ford Algorithm) Vs Link State Routing (Dijikstra's)	
	2.2 Interior Gateway Routing Protocols - RIP, OSPF & EIGRP & Exterior Routing Protocols- Border Gateway Protocol (BGP)	
	2.3 IP Routing using FLSM- Fixed Length Subnet Masking and VLSM- Variable Length Subnet Masking, Designing Subnetting using VLSM and Manual Route Summarization Vs Auto-summarization	
	2.4 Spanning Tree Protocol- STP & Rapid STP (IEEE 802.1d & IEEE 802.1w) & STP Configuration with verification	
	2.5 IP Access Control Lists – Standard and Extended ACL with Wildcard masks, Named IP ACL	
3	**Virtual Private Networks & Scaling the IP address space**	**10**
	3.1 VPN Fundamentals, IPsec VPNs- IPsec Encryption, IPsec Key Exchange, IPsec Authentication & Message Integrity, IPsec Implementation Considerations, SSL VPNs	
	3.2 CIDR - Private Addressing & Route Aggregation	
	3.3 Network Address Translation(NAT) – Static NAT & Dynamic NAT & Port Address Translation	
4	**Multi-Protocol Label Switching (MPLS) & Software Defined Networking – SDN**	**08**
	4.1 MPLS Technology & its use, Label Distribution in MPLS, MPLS services- Traffic Engineering using QoS, Configuring MPLS	
	4.2 SDN – Benefits & differences from Classical Networking, Models of SDN, SDN Architecture, QoS, Scalability & Security in SDN – Features & Issues	
	Total hours	**42**

Suggested List of Experiments:
(*However Instructor is free to design his/her own experiments as per the guidelines*)

Laboratory Experiments: (Any seven)
1. Configuring Cisco 2960 Catalyst Switch & 2811 Router using CLI on Cisco packet tracer
2. Study & evaluation of Routing Protocols – using Riverbed Modeller
   a. RIP – with route poisoning
   b. OSPF with load balancing
3. Designing a Campus Network
   a. Implement VLAN configuration
   b. Implement STP Pruning
   c. Troubleshooting LAN Switching & Isolating VLAN Trunking problems
4. Implementing the Spanning Tree Protocol –
   a. Network Convergence & Security
5. Implementing Port Security & Access Lists for Firewalls and DMZs
6. Implementing SNAT- DNAT & PAT Configuration with troubleshooting
7. Implementing server load threshold limits and latency using Riverbed modeler.
8. Study of IoT gateway.

Books Recommended:

Textbooks:
1. Wendell Odom/ Lammle Todd, "CCNA ICND1-2: Official Exam Certification Guide"
2. Darren L. Spohn , "Data Network Design" , McGraw Hill Education"

Reference Books:
1. William Stallings, "Wireless Communications and Networks", Pearson Ed., 2nd Edition
2. Vijay Garg, "Wireless Communication and networking" , Morgan Kaufmann Publishers
3. Carr and Snyder, " Data communication and network security" , McGraw Hill ,1ST edition
4. Beherouz A Forouzan , "TCP /IP Protocol Suite" , Tata McGraw Hill Education ,4th edition.

Evaluation Scheme:

Semester End Examination (A):

Theory:
1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Laboratory:
1. Oral examination will be based on the entire syllabus including, the practical performed during laboratory sessions.

Continuous Assessment (B):

Theory:
1. Two term tests of 25 marks each will be conducted during the semester out of which; one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Laboratory: (Term work)

Term work shall consist of minimum 7 experiments, 1 Power Point Presentation and minimum 2 assignments.

The distribution of marks for term work shall be as follows:

Laboratory work:	15 Marks
Assignment/Quiz:	10 Marks
Total:	**25 Marks**

The final certification and acceptance of term work will be subject to satisfactory performance of laboratory work and upon fulfilling minimum passing criteria in the term work.

Prof. Mayur Parulekar	**Dr. Prasad Joshi**	**Dr. Prasad Joshi**	**Dr. Hari Vasudevan**
Prepared by	Checked by	Head of the Department	Principal

Program: Final Year (Common for All Programs)						Semester: VIII			
Course: Project Management						**Course Code: DJ19ILO8021**			
Teaching Scheme (Hours / week)				**Evaluation Scheme**					
				Semester End Examination Marks (A)	**Continuous Assessment Marks (B)**				**Total marks (A+ B)**
				Theory	**Term Test 1**	**Term Test 2**	**Avg.**		
Lectures	**Practical**	**Tutorial**	**Total Credits**						
				75	25	25	25		100
				Laboratory Examination	**Term work**			**Total Term work**	
3	--	--	3	**Oral** / **Practical** / **Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**			--
				-- -- --	--	--		--	

Pre-requisites: Basic concepts of Management.

Objectives:
1. To familiarize the students with the use of a structured methodology/approach for every unique project undertaken, utilizing project management concepts, tools and techniques.
2. To appraise the students with the project management life cycle and make them knowledgeable about the various phases from project initiation through closure.

Outcomes: On completion of the course, learner will be able to:
1. Explain project management life cycle and the various project phases as well as the role of project manager.
2. Apply selection criteria and select an appropriate project from different options.
3. Create a work break down structure for a project and develop a schedule based on it. Manage project risk strategically.
4. Use Earned value technique and determine & predict status of the project.
5. Capture lessons learned during project phases and document them for future reference.

Detailed Syllabus (Unit wise)		
Unit	Description	Duration in Hours
1	**Project Management Foundation:** Definition of a project, Project Vs Operations, Necessity of project management, Triple constraints, Project life cycles (typical & atypical) Project phases and stage gate process. Role of project manager, Negotiations and resolving conflicts, Introduction to project leadership, ethics in projects, Multicultural and virtual projects, Project management in various organization structures, PM knowledge areas as per Project Management Institute (PMI).	07
2	**Initiating Projects:** How to get a project started, selecting project strategically, Project selection models (Numeric /Scoring Models and Non-numeric models), Project portfolio process, Project sponsor and creating charter, Effective project team, Stages of team development & growth (forming, storming, norming &performing), team dynamics.	08
3	**Project Planning:** Work Breakdown structure (WBS) and linear responsibility chart, Project cost estimation and budgeting, Top down and bottoms up budgeting, Networking and Scheduling techniques, PERT, CPM, Crashing project time, Resource loading and levelling, Goldratt's critical chain, GANTT chart, Project Stakeholders and Communication plan, Introduction to Project Management Information System (PMIS). **Risk Management in projects:** Risk management planning, Risk identification and risk register, Qualitative and quantitative risk assessment, Probability and impact matrix. Risk response strategies for positive and negative risks.	12
4	**Monitoring and Controlling Projects** Planning monitoring and controlling cycle, Information needs and reporting, engaging with all stakeholders of the projects, communication and project meetings. Earned Value Management techniques for measuring value of work completed, using milestones for measurement, change requests and scope creep, Project audit. **Project Contracting** Project procurement management, contracting and outsourcing.	08
5	**Closing the Project:** Customer acceptance, Reasons of project termination, Various types of project terminations (Extinction, Addition, Integration, Starvation), Process of project termination, completing a final report, doing a lessons learned analysis, acknowledging successes and failures.	07

Books Recommended:
Text books:
1. Project Management: A managerial approach, Jack Meredith & Samuel Mantel, 7th Edition, Wiley India.
2. Project Management: The Managerial Process, 6th edition, Erik Larson, Clifford Gray, McGraw Hill Education.

Reference Books:
1. A Guide to the Project Management Body of Knowledge (PMBOK® Guide), 5th Ed, Project Management Institute PA, USA.
2. Project Management, Gido Clements, Cengage Learning.
3. Project Management, Gopalan, Wiley India.
4. Project Management, Dennis Lock, 9th Edition, Gower Publishing England.

Syllabus for Final Year of B.Tech. (Common for All Programs)
Semester VIII (Autonomous)
(Academic Year 2022-2023)

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Program: Final Year (Common for All Programs)							Semester: VIII	
Course: Entrepreneurship Development and Management							**Course Code: DJ19ILO8022**	
Teaching Scheme (Hours / week)				**Evaluation Scheme**				
				Semester End Examination Marks (A)	**Continuous Assessment Marks (B)**			**Total marks (A+ B)**
				Theory	**Term Test 1**	**Term Test 2**	**Avg.**	
Lectures	**Practical**	**Tutorial**	**Total Credits**	75	25	25	25	100
				Laboratory Examination	**Term work**		**Total Term work**	
3	--	--	3	Oral / Practical / Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		--
				-- / -- / --	--	--	--	

Pre-requisites: Basic concepts of Management.

Objectives:
1. To develop entrepreneurial abilities by providing background information about support systems, skill sets, financial and risk covering institutions.
2. To appraise the students with the fundamentals that can help them to make right decisions for starting and running an enterprise.

Outcomes: On completion of the course, learner will be able to:
1. Develop idea generation, creative and innovative skills
2. Prepare a Business Plan
3. Compare different entrepreneur supporting institutions
4. Correlate suitable MSME scheme for an entrepreneur
5. Interpret financial and legal aspect of a business.

Detailed Syllabus (Unit wise)		
Unit	**Description**	**Duration in Hours**
1	**Entrepreneur & Entrepreneurship:** Meaning of entrepreneur - Evolution of the concept - Functions of an Entrepreneur - Types of Entrepreneurs - Intrapreneur- an emerging class - Concept of Entrepreneurship - Evolution of Entrepreneurship - Development of Entrepreneurship - Entrepreneurial Culture - Stages in entrepreneurial process - Develop idea generation, creative and innovative skills	6
2	**Business Planning Process:** Meaning of business plan - Business plan process - Advantages of business planning - Marketing plan - Production/operations plan - Organization plan - Financial plan - Final Project Report with Feasibility Study - Preparing a model project report for starting a new venture.	10
3	**Institutions Supporting Entrepreneurs:** Small industry financing developing countries - A brief overview of financial institutions in India - Central level and state level institutions - SIDBI - NABARD - IDBI - SIDCO - Indian Institute of Entrepreneurship - District Industries Centers - Single Window System.	6
4	**Micro, Small, and Medium Enterprises (MSMES)** MSMEs – Definition and Significance in Indian Economy; MSME Schemes, Challenges and Difficulties in availing MSME Schemes, Forms of Business; Make-In India, Start-Up India, Stand-Up India. Women Entrepreneurship; Rural Entrepreneurship; Family Business and First-Generation Entrepreneurs	8
5	**Finance, Account, Costing and Legal Aspect of Business** Funding new ventures – Conventional Source of Finance - bootstrapping, crowd sourcing- angel investors, VCs, debt financing , due diligence, Legal aspects of business (IPR, GST, Labour law)- Cost, volume, profit and break-even analysis - Margin of safety and degree of operating leverage - Capital budgeting for comparing projects or opportunities - Product costing- Product pricing- Introduction to financial statements - Profit & Loss statement - Balance sheet - Cash flow - Closure of Business	12

Books Recommended:

Reference Books:
1. Effective Entrepreneurial Management: Strategy, Planning, Risk Management, and Organization - by Robert D. Hisrich • Veland Ramadani, Springer Publication (2017)
2. Entrepreneurship- Theory,Process Practice –by Donald F.Kuratko, Cengage Learning(2014)
3. Entrepreneurship 6/E –by Robert D. Hisrich McGraw-Hill Education (India) (2011)
4. Entrepreneurship and small business- by Burns, P. New Jersey: Palgrave. (2001).
5. Innovation and entrepreneurship by Drucker. F. Peter, Harper business, (2006).
6. Entrepreneurship development small business enterprises, Poornima M Charantimath Pearson Publication (2013)
7. Entrepreneurial Development -Jayshree Suresh,Margham Publishers,Chennai
8. The Design of Business- by Martin Roger, Harvard Business Publishing (2009)
9. Entrepreneurship- by Roy Rajiv Oxford University Press (2011)

Syllabus for Final Year of B.Tech. (Common for All Programs)
Semester VIII (Autonomous)
(Academic Year 2022-2023)

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Program: Final Year (Common for All Programs)						Semester: VIII		
Course: Corporate Social Responsibility						Course Code: DJ19ILO8023		
Teaching Scheme (Hours / week)				**Evaluation Scheme**				
				Semester End Examination Marks (A)	**Continuous Assessment Marks (B)**			**Total marks (A+ B)**
				Theory	**Term Test 1**	**Term Test 2**	**Avg.**	
Lectures	**Practical**	**Tutorial**	**Total Credits**	75	25	25	25	100
				Laboratory Examination		**Term work**		**Total Term work**
3	--	--	**3**	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	--
				--	--	--	--	--	--

Objectives:
1. To make students understand the concept, theories and application of CSR for the Development of the Society.

Outcomes: On completion of the course, learner will be able to:
1. Understand the key characteristics of Corporate Social Responsibility (CSR) in the context of present-day management.
2. Apprise regarding business decision-making which is informed by ethical values and respect for people communities and the environment.
3. Become aware of creating a strategic plan that enables an organization to reach out to its internal and external stakeholders with consistent messages.
4. Understand critical issues of Corporate Social Responsibility (CSR) in a cross-cultural setting

Syllabus for Final Year of B.Tech. (Common for All Programs)
Semester VIII (Autonomous)
(Academic Year 2022-2023)

Unit	Description	Duration in Hours
	Detailed Syllabus (Unit wise)	
1	**Introduction to CSR** Meaning and Definition, History of CSR, Concepts of Charity, Corporate philanthropy, Corporate Citizenship, Sustainability and Stakeholder Management. Environmental aspect of CSR Chronological evolution and Models of CSR in India Carroll's model Major codes on CSR Initiatives in India.	06
2	**International framework for Corporate Social Responsibility** Millennium Development Goals, Sustainable Development Goals, Relationship between CSR and MDGs. United Nations (UN) Global Compact 2011. UN guiding principles on business and human rights. OECD CSR policy tool, ILO tri-partite declaration of principles on multinational enterprises and social policy.	10
3	**CSR-Legislation in India and the World** Section 135 of Companies Act 2013.Scope for CSR Activities under Schedule VII, Appointment of Independent Directors on the Board, and Computation of Net Profit's Implementing Process in India.	10
4	**The Drivers of CSR in India** Market based pressure and incentives, civil society pressure, the regulatory environment in India Counter trends, Review of current trends and opportunities in CSR, Review of successful corporate initiatives and challenges of CSR. Case Studies of Major CSR Initiatives Corporate Social Responsibility and Public-Private Partnership (PPP)	08
5	**Identifying key stakeholders of CSR** Role of Public Sector in Corporate, government programs, Nonprofit and Local Self Governance in implementing CSR, Global Compact Self-Assessment Tool, National Voluntary Guidelines by Govt. of India, Roles and responsibilities of corporate foundations.	08

Books Recommended:

Text Books:
1. Corporate Social Responsibility in India, Sanjay K Agarwal, Sage Publications, 2008
2. Corporate Social Responsibility in India, Bidyut Chakrabarty, Routledge, New Delhi, 2015.

Reference Books:
1. Corporate Social Responsibility: An Ethical Approach, Mark S. Schwartz, Broadview Press, 2011
2. Attaining Sustainable Growth through Corporate Social Responsibility, George Pohle and Jeff Hittner, IBA Global Business Services, 2008
3. Strategic Corporate Social Responsibility: Stakeholders in a Global Environment, William B. Werther Jr. and David Chandler, 2nd Edition, Sage Publications, 2011

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Program: Final Year (Common for All Programs)							Semester: VIII		
Course: Human Resource Management							Course Code: DJ19ILO8024		
Teaching Scheme (Hours / week)				**Evaluation Scheme**					
				Semester End Examination Marks (A)			**Continuous Assessment Marks (B)**		**Total marks (A+ B)**
				Theory			**Term Test 1**	**Term Test 2**	Avg.
Lectures	**Practical**	**Tutorial**	**Total Credits**	75			25	25	25	100
				Laboratory Examination			**Term work**		**Total Term work**	--
				Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	
3	**--**	**--**	**3**	--	--	--	--	--	--

Objectives:
1. To introduce the students with basic concepts, techniques and practices of the human resource management.
2. To provide opportunity of learning Human resource management (HRM) processes, related with the functions, and challenges in the emerging perspective of today's organizations.
3. To familiarize the students about the latest developments, trends & different aspects of HRM.
4. To acquaint the student with the importance of inter-personal & inter-group behavioral skills in an organizational setting required for future stable engineers, leaders and managers.

Outcomes: On completion of the course, learner will be able to:
1. Understand the concepts, aspects, techniques and practices of the human resource management.
2. Understand the Human resource management (HRM) processes, functions, changes and challenges in today's emerging organizational perspective.
3. Gain knowledge about the latest developments and trends in HRM.
4. Apply the knowledge of behavioral skills learnt and integrate it with in inter personal and intergroup environment emerging as future stable engineers and managers.

Detailed Syllabus (Unit wise)		
Unit	**Description**	**Duration in Hours**
1	**Introduction to HR** Human Resource Management- Concept, Scope and Importance, Interdisciplinary Approach Relationship with other Sciences, Competencies of HR Manager, HRM functions. Human resource development (HRD): changing role of HRM – Human resource Planning, Technological change, Restructuring and rightsizing, Empowerment, TQM, Managing ethical issues.	07
2	**Organizational Behaviour (OB)** Introduction to OB Origin, Nature and Scope of Organizational Behaviour, Relevance to Organizational Effectiveness and Contemporary issues. Personality: Meaning and Determinants of Personality, Personality development, Personality Types, Assessment of Personality Traits for Increasing Self Awareness. Perception: Attitude and Value, Effect of perception on Individual Decision-making, Attitude and Behaviour. Motivation: Theories of Motivation and their Applications for Behavioural Change (Maslow, Herzberg, McGregor); Group Behaviour and Group Dynamics: Work groups formal and informal groups and stages of group development, Team Effectiveness: High performing teams, Team Roles, cross functional and self-directed team. Case study.	08
3	**Organizational Structure & Design** Structure, size, technology, Environment of organization; Organizational Roles & conflicts: Concept of roles; role dynamics; role conflicts and stress. Leadership: Concepts and skills of leadership, Leadership and managerial roles, Leadership styles and contemporary issues in leadership. Power and Politics: Sources and uses of power; Politics at workplace, Tactics and strategies.	08
4	**Human resource Planning** Recruitment and Selection process, Job-enrichment, Empowerment – Job Satisfaction, employee morale. Performance Appraisal Systems: Traditional & modern methods, Performance Counselling, Career Planning. Training & Development: Identification of Training Needs, Training Methods. **Strategic HRM:** Role of Strategic HRM in the modern business world, Concept of Strategy, Strategic Management Process, Approaches to Strategic Decision Making; Strategic Intent – Corporate Mission, Vision, Objectives and Goals.	09
5	**Labor Laws & Industrial Relations:** Evolution of IR, IR issues in organizations, Overview of Labor Laws in India; Industrial Disputes Act, Trade Unions Act, Shops and Establishments Act. **Emerging Trends in HR** Organizational development; Business Process Re-engineering (BPR), BPR as a tool for organizational development, managing processes & transformation in HR. Organizational Change, Culture, Environment.	10

	Cross Cultural Leadership and Decision Making: Cross Cultural Communication and diversity at work, Causes of diversity, managing diversity with special reference to handicapped, women and ageing people, intra company cultural difference in employee motivation.	

Books Recommended:

Reference Books:
1. Stephen Robbins, Organizational Behavior, 16th Ed, 2013
2. V S P Rao, Human Resource Management, 3rd Ed, 2010, Excel publishing
3. Aswathapa, Human resource management: Text & cases, 6th edition, 2011
4. C. B. Mamoria and S V Gankar, Dynamics of Industrial Relations in India, 15th Ed, 2015, Himalaya Publishing, 15thedition, 2015
5. P. Subba Rao, Essentials of Human Resource management and Industrial relations, 5th Ed, 2013, Himalaya Publishing
6. Laurie Mullins, Management & Organizational Behavior, Latest Ed, 2016, Pearson Publications

Evaluation Scheme:
Semester End Examination (A):
Theory:
1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):
Theory:
1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Program: Final Year (Common for All Programs)							Semester: VIII		
Course: Corporate Finance Management							Course Code: DJ19ILO8025		
Teaching Scheme (Hours / week)				**Evaluation Scheme**					
				Semester End Examination Marks (A)			**Continuous Assessment Marks (B)**		**Total marks (A+ B)**
				Theory			**Term Test 1**	**Term Test 2**	**Avg.**
Lectures	**Practical**	**Tutorial**	**Total Credits**	75			25	25	25	100
				Laboratory Examination			**Term work**		**Total Term work**	--
3	--	--	3	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**	
				--	--	--	--	--	--

Objectives:

1. Overview of Indian financial system, instruments and market.
2. Basic concepts of value of money, returns and risks, corporate finance, working capital and its management.
3. Knowledge about sources of finance, capital structure, dividend policy.

Outcomes: On completion of the course, learner will be able to:

1. Understand Indian finance system.
2. Apply concepts of time value money and risk returns to product, services and business.
3. Understand corporate finance; evaluate and compare performance of multiple firms.
4. Take Investment, finance as well as dividend decisions.

Syllabus for Final Year of B.Tech. (Common for All Programs)
Semester VIII (Autonomous)
(Academic Year 2022-2023)

	Detailed Syllabus (Unit wise)	
Unit	Description	Duration in Hours
1	**Overview of Indian Financial System:** Characteristics, Components and Functions of Financial System. Financial Instruments: Meaning, Characteristics and Classification of Basic Financial Instruments — Equity Shares, Preference Shares, Bonds-Debentures, Certificates of Deposit, and Treasury Bills. Financial Markets: Meaning, Characteristics and Classification of Financial Markets — Capital Market, Money Market and Foreign Currency Market Financial Institutions: Meaning, Characteristics and Classification of Financial Institutions — Commercial Banks, Investment-Merchant Banks and Stock Exchanges	07
2	**Overview of Corporate Finance:** Objectives of Corporate Finance; Functions of Corporate Finance—Investment Decision, Financing Decision, and Dividend Decision. Financial Ratio Analysis: **Overview of Financial Statements:**-Balance Sheet, Profit and Loss Account, and Cash Flow Statement; Purpose of Financial Ratio Analysis; Liquidity Ratios; Efficiency or Activity Ratios; Profitability Ratios; Capital Structure Ratios; Stock Market Ratios; Limitations of Ratio Analysis	09
3	**Concepts of Returns and Risks:** Measurement of Historical Returns and Expected Returns of a Single Security and a Two-security Portfolio; Measurement of Historical Risk and Expected Risk of a Single Security and a Two-security Portfolio. **Time Value of Money**: Future Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Present Value of a Lump Sum, Ordinary Annuity, and Annuity Due; Continuous Compounding and Continuous Discounting.	07
4	**Working Capital Management:** Concepts of Meaning Working Capital; Importance of Working Capital Management; Factors Affecting an Entity's Working Capital Needs; Estimation of Working Capital Requirements; Management of Inventories; Management of Receivables; and Management of Cash and Marketable Securities. **Capital Budgeting:** Meaning and Importance of Capital Budgeting; Inputs for Capital Budgeting Decisions; Investment Appraisal Criterion—Accounting Rate of Return, Payback Period, Discounted Payback Period, Net Present Value(NPV), Profitability Index, Internal Rate of Return (IRR), and Modified Internal Rate of Return (MIRR)	10
5	**Capital Structure:** Factors Affecting an Entity's Capital Structure; Overview of Capital Structure Theories and Approaches— Net Income Approach, Net Operating Income Approach; Traditional Approach, and Modigliani-Miller Approach. Relation between Capital Structure and Corporate Value; Concept of Optimal Capital Structure **Dividend Policy:** Meaning and Importance of Dividend Policy; Factors Affecting an Entity's Dividend Decision; Overview of Dividend Policy Theories and Approaches— Gordon's Approach, Walter's Approach, and Modigliani-Miller Approach	09

Books Recommended:

Reference Books:
1. Fundamentals of Financial Management, 13th Edition (2015) by Eugene F. Brigham and Joel F. Houston; Publisher: Cengage Publications, New Delhi.
2. Analysis for Financial Management, 10th Edition (2013) by Robert C. Higgins; Publishers: McGraw Hill Education, New Delhi.

3. Indian Financial System, 9th Edition (2015) by M. Y. Khan; Publisher: McGraw Hill Education, New Delhi.
4. Financial Management, 11th Edition (2015) by I. M. Pandey; Publisher: S. Chand (G/L) & Company Limited, New Delhi.
5. Financial Management, Theory & Practice 8th Edition (2011), by Prasanna Chandra: Tata McGraw Hill Education Private Limited, New Delhi.

Evaluation Scheme:
Semester End Examination (A):
Theory:
1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):
Theory:
1. Consisting **One Class Tests for 25 marks** based on approximately 50% of contents and One case study with presentations for 25 Marks.
2. Total duration allotted for writing test paper is 1 hr.
3. Average of the marks scored in the tests and case study will be considered for final grading.

Program: Final Year (Common for All Programs)						Semester: VIII				
Course: Logistic and Supply Chain Management						Course Code: DJ19ILO8026				
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)			Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				75			25	25	25	100
				Laboratory Examination			Term work		Total Term work	
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		--
				--	--	--	--	--	--	

Objectives:

1. To acquaint with the concept of key drivers of supply chain performance and their inter-relationships with strategy.
2. To acquaint with the design problems and develop an understanding of information technology in supply chain optimization.
3. To acquaint with the complexity of inter-firm and intra-firm coordination in implementing programs such as e-collaboration, quick response, jointly managed inventories and strategic alliances.

Outcomes: On completion of the course, learner will be able to:

1. Demonstrate the functional strategy map of supply chain management.
2. Analyze the determinants of Supply Chain and Transportation networks design.
3. Demonstrate the need of coordination and sourcing decisions in supply chain.
4. Understand pricing, revenue management and role of IT in supply chain.
5. Understand various sustainability aspects of a supply chain.

	Detailed Syllabus (Unit wise)	
Unit	Description	Duration in Hours
1	**Understanding the Supply Chain:** Objective, Importance, Decision Phases, Process Views. **Achieving Strategic Fit and Scope:** Competitive and Supply Chain Strategies, Achieving Strategic Fit, Expanding Strategic Scope, Challenges to Achieving and Maintaining Strategic Fit. **Supply Chain Drivers and Metrics:** Financial Measures of Performance, Drivers of Supply Chain Performance, Framework for Structuring Drivers, Facilities, Inventory, Transportation, Information, Sourcing, Pricing. **Creating the Responsive Supply Chain:** Product push versus demand pull, The Japanese philosophy, The foundations of agility, A route-map to responsiveness.	08
2	**Designing the Supply Chain and Transportation Networks** **Designing Distribution Networks:** The Role of Distribution in the Supply Chain, Factors Influencing Distribution Network Design, Design Options for a Distribution Network. **Network Design in the Supply Chain:** The Role of Network Design in the Supply Chain, Factors Influencing Network Design Decisions, Framework for Network Design Decisions, Models for Facility Location and Capacity Allocation. **Designing Global Supply Chain Networks:** The Impact of Globalization on Supply Chain Networks, The Offshoring Decision: Total Cost, Risk Management in Global Supply Chains, Discounted Cash Flows, Evaluating Network Design Decisions Using Decision Trees. **Transportation in a Supply Chain:** The Role of Transportation in a Supply Chain, Modes of Transportation and their Performance Characteristics, Design Options for a Transportation Network, Trade-Offs in Transportation Design, Tailored Transportation.	14
3	**Coordination in a Supply Chain:** Lack of Supply Chain Coordination and the Bullwhip Effect, The Effect on Performance of Lack of Coordination, Obstacles to Coordination in a Supply Chain, Managerial Levers to Achieve Coordination, Continuous Replenishment and Vendor-Managed Inventories, Collaborative Planning, Forecasting, and Replenishment. **Sourcing Decisions in a Supply Chain:** The Role of Sourcing in a Supply Chain, In-House or Outsource, Third- and Fourth-Party Logistics Providers, Using Total Cost to Score and Assess Suppliers, Supplier Selection— Auctions and Negotiations, Contracts, Risk Sharing and Supply Chain Performance, Design Collaboration, The Procurement Process.	07

4	**Pricing and Revenue Management in a Supply Chain:** The Role of Pricing and Revenue Management in a Supply Chain, Pricing and Revenue Management for Multiple Customer Segments, Pricing and Revenue Management for Perishable Assets, Pricing and Revenue Management for Seasonal Demand, Pricing and Revenue Management for Bulk and Spot Contracts. **Information Technology in a Supply Chain:** The Role of IT in a Supply Chain, The Supply Chain IT Framework, Customer Relationship Management, Internal Supply Chain Management, Supplier Relationship Management, The Transaction Management Foundation, Managing the supply chain as a network, Seven major business transformations, From 3PL to 4PL. The Future of IT in the Supply Chain.	08
5	**Creating a Sustainable Supply Chain:** The Role of Triple Bottom Line, Key Metrics for Sustainability, Greenhouse gases and the supply chain, Reducing the transport-intensity of supply chains, Beyond the carbon footprint, Reduce, reuse, recycle, Sustainability and Supply Chain Drivers. **Introduction to the Supply Chain of the Future:** Emerging Megatrends.	05

Books Recommended:

Reference Books:
1. Logistics & Supply Chain Management, Martin Christopher, Pearson Education Limited, 2016.
2. Supply Chain Management Strategy, Planning, and Operation, Sunil Chopra and Peter Meindl, Pearson, 2016.
3. Essentials of Supply Chain Management, Michael H. Hugos, Wiley, 2018.
4. Supply Chain Management For Dummies, Daniel Stanton, Wiley, 2020.
5. Global Supply Chain and Operations Management A Decision-Oriented Introduction to the Creation of Value, Dmitry Ivanov, Alexander Tsipoulanidis and Jörn Schönberger, Springer International Publishing, 2016.
6. Supply Chain Management, Sinha, McGraw-Hill Education (India) Pvt Limited, 2012.

Evaluation Scheme:

Semester End Examination (A):

Theory:
1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:
1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Program: Final Year (Common for All Programs)							Semester: VIII		
Course: IPR and Patenting							Course Code: DJ19ILO8027		

Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)	Continuous Assessment Marks (B)			Total marks (A+ B)	
Lectures	Practical	Tutorial	Total Credits	Theory	Term Test 1	Term Test 2	Avg.		
				75	25	25	25	100	
				Laboratory Examination			Term work		Total Term work
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	--
				--	--	--	--	--	--

Objectives:
1. Understanding, defining and differentiating different types of intellectual properties (IPs)
2. Assessing different IP management (IPM) approaches
3. Exposure to the Legal management of IP and understanding of real life practice of IPM.

Outcomes: On completion of the course, learner will be able to:
1. Recognize the crucial role of IP for the purposes of product and technology development.
2. Understand how and when to file a patent
3. Apply the knowledge to understand the entire ecosystem
4. Derive value from IP and leverage its value in new product and service development

Syllabus for Final Year of B.Tech. (Common for All Programs)
Semester VIII (Autonomous)
(Academic Year 2022-2023)

Detailed Syllabus (Unit wise)		
Unit	**Description**	**Duration in Hours**
1	**Concept of Intellectual Property Law** Idea/Expression dichotomy, Introduction and the need for intellectual property right (IPR), Intellectual Property laws, IPR in India: Genesis and development, IPR abroad, Major International Instruments concerning Intellectual Property Rights: Paris Convention, the Berne Convention, the Universal Copyright Convention, the WIPO Convention, the Patent Cooperation Treaty, the TRIPS Agreement, incentive theory, types of IPR, India`s New National IP Policy, 2016, Govt. Schemes in IPR IP	**06**
2	**Patents and Trademarks** Elements of Patentability: Novelty, Non Obviousness, Industrial Application, Non Patentable Subject Matter, Registration Procedure, Rights and Duties of Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties, Patent office and Appellate Board, Case study of existing patents related to software, healthcare, devices Concept of Trademarks, Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks), Non Registrable Trademarks, Registration of Trademarks, Rights of holder and assignment and licensing of marks, Infringement, Remedies & Penalties, Trademarks registry and appellate board	**12**
3	**Copyrights and Design** Copyrights: Nature, Subject matter: original literary, dramatic, musical, artistic works, cinematograph films and sound recordings, Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright, Infringement, Remedies & Penalties, Related Rights, distinction between related rights and copyrights Design: meaning and concept of novel and original, procedure for registration, effect of registration and term of protection	**10**
4	**GI, PVP and LDP** Geographical indication: meaning, difference between GI and trademarks, procedure for registration, effect of registration and term of protection Plant variety protection: meaning, benefit sharing, farmers' rights, procedure for registration, effect of registration and term of protection Layout Design protection: meaning, procedure for registration, effect of registration, term of protection	**08**
5	**Beyond IP** Introduction to Competition Law: concept of competition, relationship and Interaction between IPR and competition law, IP and competition issues, Technology transfer agreements. EU experience with IP and Competition Law, Indian Competition Act and IPR protection, IPR issues in merger and acquisition, harmonization of IP protection and competition Law in India	**06**

Books Recommended:

Reference Books:

1. Feroz Ali, The Law of Patents, LexisNexis
2. Ronald D. Slusky, Invention Analysis and Claiming – A Patent Lawyer's Guide, Second Edition, American Bar Association, 2012.
3. Feroz Ali, The Touchstone Effect – The Impact of Pre-grant Opposition on Patents, LexisNexis, 2009.

4. Innovation and entrepreneurship by Drucker. F. Peter, Harper business, (2006).
5. Intellectual Property Rights, Deborah. E. Bouchoux, Cengage Learing.
6. Intellectual Property Rights– Unleashmy The Knowledge Economy, Prabuddha Ganguli, Tate Mc Graw Hill Publishing Company Ltd.,
7. The Design of Business- by Martin Roger, Harvard Business Publishing (2009)

Evaluation Scheme:
Semester End Examination (A):
Theory:
1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):
Theory:
1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Program: Final Year (Common for All Programs)						Semester: VIII				
Course: Digital Marketing Management						Course Code: DJ19ILO8028				
Teaching Scheme (Hours / week)				**Evaluation Scheme**						
				Semester End Examination Marks (A)	**Continuous Assessment Marks (B)**			**Total marks (A+ B)**		
				Theory	**Term Test 1**	**Term Test 2**	**Avg.**			
Lectures	**Practical**	**Tutorial**	**Total Credits**	75	25	25	25	100		
				Laboratory Examination			**Term work**		**Total Term work**	--
3	--	--	3	**Oral**	**Practical**	**Oral & Practical**	**Laboratory Work**	**Tutorial / Mini project / presentation/ Journal**		
				--	--	--	--	--	--	

Objectives:

1. To explain the evolution of digital marketing and outline the underlying technology and frameworks within which digital marketing operates.
2. To understand digital marketing business models elucidating on the six core digital value elements and how they can be used to generate customer value.
3. To understand the key concepts of developing strategy for digital business and the emerging business structures.
4. To plan the digital marketing strategy roadmap, its four key stages and their elements and understand the 6S Digital Marketing Implementation Stages.
5. To understand digital marketing planning & operations setup.
6. To explain the implementation of search campaigns which include Search Engine Marketing (SEM) and Search Engine Optimization (SEO) concepts.
7. To explain upcoming digital marketing concepts including Big Data and Internet of Things (IoT), Small and Medium Businesses (SMB), B2B marketing and Social, Local and Mobile (SoLoMo) concept.

Outcomes: On completion of the course, learner will be able to:

1. Understand the digital marketing framework & model and consumer behaviour.
2. Develop digital marketing strategy roadmap.
3. Explain the terminology and concepts for developing web-specific media plans.
4. Understand concepts related to digital campaign management and revenue generation models.
5. Get a perspective on global digital marketing technology/tools and future trends.

Detailed Syllabus (Unit wise)		
Unit	Description	Duration in Hours
1	**Introduction to Digital Marketing** Emergence of Digital Marketing as a tool, media consumption drivers for new marketing environment, applications and benefits of digital marketing. **Digital Marketing Framework** Delivering enhanced customer value, market opportunity analysis and digital services development, ASCOR framework, critical success factors for digital marketing. **Digital Marketing Models Creation** Factors impacting digital marketplace, value chain digitization, business models. **The Consumer for Digital Marketing** Consumer behavior on the internet, evolution of consumer behavior models, managing consumer demand, integrated marketing communications (IMC), impact of digital channels on IMC.	08
2	**Digital marketing Strategy Development** Elements of assessment phase, macro-micro environmental analysis, marketing situation analysis. **Digital Marketing Internal Assessment and Objectives Planning** Analyzing present offerings mix, marketing mix, core competencies analysis and internal resource mapping. Digital presence analysis, digital marketing objectives development and review. **Digital Marketing Strategy Definition** Understanding digital business strategy and structures, consumer development strategy, offering mix for Digital, digital pricing models, managing promotional channels and developing the extended Ps- People, process, programs and performance. **Digital marketing Strategy Roadmap** Developing digital marketing strategy roadmap, the 6s digital marketing implementation strategy, marketing across the product life cycle.	13
3	**Digital Marketing Planning and Setup** Understanding digital media planning terminology and stages, steps to creating marketing communications strategy, introduction to search marketing, display marketing, social media marketing. **Digital Marketing Operations Setup** Basics of lead generation and conversion marketing, website content development and management, elements of user experience, web usability and evaluation.	08
4	**Digital marketing Execution** Basic elements of digital campaign management, search execution, display execution, social media execution, content marketing. **Digital marketing Execution Elements** Digital revenue generation models, managing service delivery and payments, managing digital implementation challenges like e commerce, internal & external and consumer specific challenges.	08

| 5 | **Digital Business – Present and Future**
Digital Marketing – Global Landscape, digital marketing overview – global spend, advertising spend, and technology/tools landscape.
Data technologies (Big data and IOT) impacting marketing, segment based digital marketing and SoLoMo – the next level of hyperlocal marketing. | 05 |

Books Recommended:

Reference Books:
1. Fundamentals of Digital Marketing by Puneet Singh Bhatia, Pearson Education Limited,
2. Digital Marketing by Seema Gupta- McGraw Hill Education.
3. Digital Marketing Excellence: Planning, Optimizing and Integrating Online Marketing by Dave Chaffey and P. R. Smith, 5 th edition, Taylor & Francis.
4. Digital Marketing: Strategy, Implementation and Practice- 6 th edition by Dave Chaffey Fiona Ellis-Chadwick, Pearson Education Limited,
5. Digital marketing by Vandana Ahuja, Oxford University Press.
6. The Art of Digital Marketing by Ian Dodson, John Wiley & Sons.

Evaluation Scheme:
Semester End Examination (A):
Theory:
1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):
Theory:
1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Program: Final Year (Common for All Programs)						Semester: VIII			
Course: Environmental Management						**Course Code: DJ19ILO8029**			
Teaching Scheme (Hours / week)				**Evaluation Scheme**					
				Semester End Examination Marks (A)	**Continuous Assessment Marks (B)**			**Total marks (A+ B)**	
				Theory	**Term Test 1**	**Term Test 2**	**Avg.**		
Lectures	**Practical**	**Tutorial**	**Total Credits**	75	25	25	25	100	
				Laboratory Examination	**Term work**		**Total Term work**	**--**	
				Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal	Total Term work
3	**--**	**--**	**3**	**--**	**--**	**--**	**--**	**--**	**--**

Pre-requisite: Knowledge of environmental science.

Objectives:
1. Understand and identify environmental issues relevant to India and global concerns
2. Learn concepts of ecology
3. Familiarise environment related legislations
4. Understand Environmental Auditing Procedures.

Outcomes: On completion of the course, learner will be able to:
1. Identify Environmental issues and get familiarized to the concept of Ecosystem and environmental management.
2. Know policies and legal aspects and understand EM system standards.
3. Understand Environment Impact assessment.
4. Understand Environment Auditing procedures.
5. Describe Environmental management Techniques

Detailed Syllabus (Unit wise)		
Unit	**Description**	**Duration in Hours**
1	**Principles of Environmental management (EM):** Introduction of EM, Definition, Ecosystem concept, Participants in EM, Ethics and the environment, International Environmental Movement, Environmental issues relevant to India.	08
2	**Policy and Legal Aspects of EM: -** Introduction to various Environmental Policies, Indian and International Environmental laws and legislation. **EM system Standards: -** Core Elements, Benefits, Certification Body Assessment & Documentation for EMS, ISO- 14000 Standards.	10
3	**Environmental Impact Assessment (EIA) :-** Purpose, steps, hierarchy of EIA, Environmental Impact Statement and Impact Indicators, Evolution of IA in India and worldwide. Preliminary stages of EIA, Impact, Prediction, Evaluation and Mitigation.	10
4	**Environmental Auditing (EA):-** Objectives, Scope and Types of EA, Audit Methodology, Elements of Audit Process, Auditing of EMS.	06
5	**Environmental Management Techniques: -** Environmental Monitoring and Modelling, Environmental technology Assessment and Environmental Risk Assessment, Eco-mapping.	08

Books Recommended:

Text Books:
1. Environmental Management, T V Ramachandra and Vijay Kulkarni, TERI Press
2. Environmental Management: Principles and Practice, C J Barrow, Routledge Publishers London, 1999

Reference Books:
1. A Handbook of Environmental Management Edited by Jon C. Lovett and David G. Ockwell, Edward Elgar Publishing
2. Indian Standard Environmental Management Systems — Requirements with Guidance for Use, Bureau Of Indian Standards, February 2005
3. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Macmillan India, 2000
4. Introduction to Environmental Management, Mary K Theodore and Louise Theodore, CRC Press
5. Environment and Ecology, Majid Hussain, 3rd Ed. Access Publishing.2015

Evaluation Scheme:
Semester End Examination (A):
Theory:
1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.
2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):

Theory:

1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Program: Final Year (Common for All Programs)						Semester: VIII				
Course: Labour and Corporate Law						Course Code: DJ19ILO8030				
Teaching Scheme (Hours / week)				Evaluation Scheme						
				Semester End Examination Marks (A)		Continuous Assessment Marks (B)				Total marks (A+ B)
				Theory		Term Test 1	Term Test 2	Avg.		
Lectures	Practical	Tutorial	Total Credits	75		25	25	25		100
				Laboratory Examination		Term work			Total Term work	
3	--	--	3	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation/ Journal		--
				--	--	--	--	--	--	

Objectives:
1. To understand the development and judicial setup of Labour Laws.
2. To learn the laws relating to Industrial Disputes, Social Security and Working conditions.
3. To analyse the laws related to corporate governance in different settings.
4. To develop awareness of legal principles involved in economic relationships and business transactions.
5. To develop an understanding of free enterprise system and legal safeguards of the same.

Outcomes: On completion of the course, learner will be able to:
1. Illustrate the role of trade union in the industrial setup.
2. Understand the important causes, impact of industrial disputes and settlement procedures.
3. To provide in-depth understanding of corporate social responsibility.
4. Apply concepts, principles and theories to understand simple business laws.
5. Analyse the principle of international business and strategies adopted by firms to expand globally

Detailed Syllabus (Unit wise)		
Unit	Description	Duration in Hours
1	**Trade Unions and Collective Bargaining:** Trade Unionism in India, Definition of Trade Union and Trade Dispute, General and Political Funds of Trade Union, Civil and Criminal Immunities of Registered Trade Unions, Recognition of Trade Union, Collective Bargaining	9
2	**Industrial Dispute and Instruments of Economic Coercion:** Industrial Dispute and Individual Dispute, Settlement of Industrial Dispute. Concept of strike – Gherao, Bandh and Lock-out, Types of Strike Rights to Strike and Lock-out	8
3	**Formation of a Company and Corporate governance:** Company and Other Forms of Business Organizations, Different Kinds of Company: One Person Company, Foreign Company. Kinds of Company Meetings and Procedure Powers, Duties and Kinds of Director: Independent Director, Women Director Different Prevention of Oppression and Mismanagement Investor Protection, Insider Trading, Corporate Fraud.	9
4	**Corporate Social Responsibility and Corporate Liquidation:** Evolution of Corporate Social Responsibility, Corporate Criminal liability, Corporate Environmental Liability Different Types of Winding up of Company, Role of Courts in Winding up of Company Merger and Acquisition of Company, Cross Border Merger, Takeover Code: Role of SEBI	8
5	**Case Studies on** A) Labour law B) Labour relations C) Corporate laws D) Securities laws	8

Books Recommended:

Reference Books:

1. Surya Narayan Misra, An Introduction to Labour and Industrial Law, Allahabad Law Agency, 1978
2. Indian Law Institute, Cases and Materials on Labour Law and Labour Relations
3. P.L. Malik, Industrial Law, Eastern Book Company, 2013
4. S.C. Srivastava, Industrial Relations and Labour Law, Vikas Publishing House, New Delhi
5. C.A. Kamal Garg, Bharat's Corporate and Allied Laws, 2013.
6. Institute of Company Secretaries of India, Companies Act 2013, CCH Wolter Kluver Business, 2013
7. Saleem Sheikh & William Rees, Corporate Governance & Corporate Control, Cavendish Publishing Ltd., 1995
8. Taxmann, A Comparative Study of Companies Act 2013 and Companies Act 1956

Evaluation Scheme:
Semester End Examination (A):
Theory:
1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice as appropriate), each carrying 15 marks, total summing up to 75 marks.

2. Total duration allotted for writing the paper is 3 hrs.

Continuous Assessment (B):
Theory:
1. Two term tests of 25 marks each will be conducted during the semester out of which, one will be a compulsory term test (on minimum 02 Modules) and the other can either be a term test or an assignment on live problems or a course project.
2. Total duration allotted for writing each of the paper is 1 hr.
3. Average of the marks scored in both the two tests will be considered for final grading.

Program: Final Year Electronics Engineering							Semester : VIII		
Course : Project - II							Course Code: DELXP804		
Teaching Scheme (Hours / week)				Evaluation Scheme					
				Semester End Examination Marks (A)			Continuous Assessment Marks (B)		Total marks (A+ B)
Lectures	Practical	Tutorial	Total Credits	Theory			Term Test 1	Term Test 2	Avg.	
				--			--	--	--	--
				Laboratory Examination			Term work			
--	12	--	6	Oral	Practical	Oral & Practical	Laboratory Work	Tutorial / Mini project / presentation / Journal	Total Term work	200
				--	--	100	100	--	100	

Objectives:

1. To acquaint with the process of undertaking literature survey/industrial visit and identifying the problem
2. To familiarize the process of problem solving in a group
3. To acquaint with the process of applying basic engineering fundamentals in the domain of practical applications
4. To inculcate the process of research Outcomes

Outcomes:

1. Do literature survey/industrial visit and identify the problem
2. Apply basic engineering fundamental in the domain of practical applications
3. Cultivate the habit of working in a team
4. Attempt a problem solution in a right approach
5. Correlate the theoretical and experimental/simulations results and draw the proper inferences
6. Prepare report as per the standard guidelines.

Guidelines for Assessment of Project II

Project II should be assessed based on following points

1. Quality of problem selected, Clarity of Problem Definition & Feasibility of problem solution
2. Relevance to the specialization / Industrial trends & Clarity of objective and scope
3. Quality of work attempted & Validation of results
4. Quality of Written and Oral Presentation

Project Report has to be prepared strictly as per University of Mumbai report writing guidelines.

Dr. Mrunal Rane	Prof. Rashmi Ravikumar	Dr. Prasad Joshi	Dr. Hari Vasudevan
Prepared by	Checked by	Head of the Department	Principal